# Popular Astronomy.

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## WILLIAM JOSEPH HUSSEY.

By RALPH H. CURTISS.

Few occurrences of scientific importance in recent years have involved so many of the elements of a tragedy as the recent death of Professor William Joseph Hussey, late Director of the Astronomical Observatory of the University of Michigan. On the 28th of October, 1926, in London enroute for South Africa where careful preparation made certain that his dream of a quarter century would be realized and his efforts of fifteen years come to abundant fruition, the end came suddenly as he talked with friends at the dinner table. Seldom is the interest in a catastrophe of this kind more keen and instant. Hundreds of colleagues in science, thousands of former students and other friends, and many less closely interested, unite in expression of deepest sympathy and kindly concern.

Professor Hussey's departure from Ann Arbor was delayed a week by an illness that was pronounced pleurisy. It was a strange experience for one who had not suffered from a serious illness in more than a score of years. It appeared to all that recovery was not complete at Professor Hussey's departure but with the physician's admonitions in mind it was hoped that a good traveller would find the journey to Africa beneficial. Incitement to activity was strong among old friends in England and an address delivered a few hours before may have hastened the end. Death was due to failure of the heart. Professor Hussey is survived by his widow, Mary McNeal Hussey to whom he was married in 1917; his son, Doctor Roland Fountain Hussey of New York City; his daughter, Miss Allis Fountain Hussey of Coleraine, Minnesota; and his step-daughter, Mrs. Hester Reed Gehring of Ann Arbor.

The chief accomplishments of Professor Hussey's career are matters of common knowledge among readers of POPULAR ASTRONOMY. It is, however, an inspiration to review them and most fitting to record them on these pages.

Born in Ohio, August 10, 1862, on a farm where funds were limited, an education was not gained without a struggle. Teaching and other work eked out available resources. Professor Hussey operated a small printing press at this time and thus developed an interest that grew with the years into one of his chief sources of recreation and diversion.

Though not able financially to enter Michigan until relatively late in his youth, he was forced to suspend studies at the end of his sophomore year, in 1884, to replenish his funds. He then became principal of schools in Ohio Station, Illinois. During vacation periods, he joined a party of railroad surveyors operating in the Northwest and very soon through the accuracy and neatness of his records found himself assigned to clerical work. Returning after three years to Michigan he graduated in Civil Engineering with the class of 1889, leaving a brilliant record behind him. For a time in 1889 he was an assistant in the Nautical Almanac Office at Washington, D. C.

Then began a period of seven years devoted principally to teaching. Instructor for three years at Michigan in Mathematics and Astronomy and Acting Director of the Detroit Observatory during the last one of these years, he was called to Leland Stanford Junior University as Assistant Professor of Astronomy in 1892 and rose in three years' time to a full professorship in that subject. During this period he visited the Lick Observatory frequently as a volunteer observer. It was during this time that his remarkable photographs and studies of the physical characteristics of Comet Rordame were made.

The years as Astronomer on the staff at Lick Observatory, from 1896 to 1905, formed for Professor Hussey a period of most intense activity in research. When but half of his first year's work was published, S. C. Chandler, then editor of the *Astronomical Journal,* wrote in part as follows, "As to comets, Hussey and Perrine are doing themselves and your observatory immense credit, not only in the amount of their work in that direction, but what is more important, in its quality. * * * I have been impressed with the careful and orderly way in which these gentlemen do their work." Space is lacking to consider here the details of Professor Hussey's researches at Lick Observatory. His photographs, orbits and micrometer observations of comets, his drawings of the planets, his micrometrical observation of satellites, but most of all his epoch making discoveries, measures and other investigations of double stars brought him international distinction and the widest recognition.

Professor Hussey's assignment, in 1897, by Director E. S. Holden to the then newly received Crossley Reflector was a high compliment to one at the beginning of his research career. But the rejection of the offer proved wise for one whose success in the important field of telescopic micrometry was already assured. Later on Director Keeler whose own reputation was of long standing could afford to hazard his efforts with an instrument of uncertain promise. When the logical time came Professor Hussey planned and supervised at the University of Michigan the construction of a "home-made" 37½-inch reflector that will long stand with the 27-inch Lamont Refractor, also a home product, as a monument to his vision and enterprise.

Professor Hussey's most notable achievements at Lick Observatory were his observations of the double stars discovered at Pulkowa and

his discovery and observation of 1338 new double stars. The report of the former studies fills Volume V of the *Lick Observatory Publications,* a model of its kind. The discoveries of double stars resulted from a survey begun independently in 1899 by Dr. R. G. Aitken and Professor Hussey but pursued jointly by them almost from the first and completed by Dr. Aitken working alone after 1905. This great work with related investigations won for both collaborators the Lalande Gold Medal of the French Academy in 1906. Subsequently, at La Plata, Professor Hussey increased the total of his double star discoveries to 1650.

In 1903, Professor Hussey examined for the Carnegie Institution the present location of the Mt. Wilson Observatory and submitted a favorable report that entered with great weight into the selection of the site. Later in the same year he continued the search for "seeing" in Australia. His last service to the Lick Observatory was rendered as observer in charge of a successful eclipse expedition to Egypt in 1905.

The period of Professor Hussey's life devoted primarily to construction, organization, and administration began when he returned to Michigan as Professor of Astronomy and Director of the Observatory in October, 1905. Though always assuming his full share of teaching, in which he was notably successful, and finding time for countless other tasks, he nevertheless kept before him always the larger problems connected with the growth and extension of the Observatory. The initial program of construction for Ann Arbor, beginning with the buildings, instrument shop and smaller instruments, culminated in the 37½-inch reflector. When this instrument was completed with its spectrographic equipment and auxiliaries in 1911, the original plans for reorganization and construction at Ann Arbor were essentially realized, and a period of research began. Professor Hussey was ready then to turn his attention in greater measure to the proposed southern station.

The original plans for reorganization and construction at Ann Arbor were just realized when there came an opportunity for similar offices at a great southern institution. The Observatory at La Plata, in Argentina, had expended considerable sums of money but then lay dormant with a group of sightly buildings and a complement of equipment needing only the attention of experts to make it productive.

On February 5, 1911, an emissary, already in touch with Professor Hussey, came to New York from the University of La Plata fully empowered to select a Director in Astronomy for that institution. A cooperative arrangement was formulated under which Professor Hussey was to add the duties of the professorship and directorship in Astronomy and Geodesy at the National University of Argentina in La Plata to those at the University of Michigan, dividing his time about equally between the two institutions. When this was quickly approved by the Regents of the University of Michigan, the incident was a source of much gratification to many interested in the betterment of pan-American relations and to those interested in scientific progress. Be-

fore departure for Argentine, in June, 1911, there were intimations that the plan of co-operation was meeting with difficulties at the southern end. But Michigan desired to carry out her part of the agreement fully and under instructions to that effect Professor and Mrs. Hussey faced southward with leave for six months.

Arrived in Argentina, July 19, 1911, it was found that the attitude of the University of La Plata was cordial and entirely favorable but that the National Government, largely through one of its ministers lately returned from Europe, had selected a candidate from that continent. After a conference with Professor Perrine at Córdoba and a study of conditions in Argentina, Professor Hussey had proposed a comprehensive plan of national scope for the development of astronomical research and instruction in that country. But the Government insisted on its own candidate or none and the University on that basis preferred the latter. When it appeared that the deadlock could not be broken, Professor Hussey, who had already made his intended study of conditions bearing upon the selection of a site for the Lamont Telescope, prepared to withdraw gracefully. He reserved a stateroom on the *S. S. Vasari* sailing September 8 and cabled his intention to reach Ann Arbor in October. At this juncture the European candidate withdrew and the college, again in authority, lost no time in cementing relations with the University of Michigan by electing the Director of its own choice. A few days later Mrs. Hussey returned to Ann Arbor. With no friends of long standing in Central Argentina Professor Hussey found himself very much alone. It lends a human touch to quote an entry from his diary made under date of September 8, 1911, "It is a long time since I have felt homesick as I do tonight." Unexpected difficulties in securing full authority at the observatory were disheartening for a time. But soon with characteristic vigor the work of reorganization was under way. When Professor Hussey sailed for the north on January 8, 1912, new contacts were firmly established, far reaching plans were well matured, and a list of nearly one hundred double stars discovered with the La Plata refractor carried deep significance in connection with plans for a double star survey of the southern sky.

Professor Hussey's return to Argentina in the summer of 1912 for a stay of eighteen months began a period of rapid progress at La Plata. Delavan, Dawson, and Crump joined the staff, the former members of which were stirred with new vigor. H. J. Colliau of the Detroit Observatory superintended the erection and equipment of an instrument shop and put the Gautier Meridian Circle, the 433-millimeter Refractor, the astrographic telescope, and the comet seeker into full working order. An eclipse expedition to Brazil from the La Plata Observatory, with a personnel consisting of Professor Hussey and Mr. Colliau, attempted observations that were prevented by clouds. Regular observations with refractor, meridian circle, and other instruments, be-

gun at this time on a large scale, continue today through the able efforts of Dawson, Manganiello, Martinez, and others. The eighth of a series of La Plata volumes, a series begun by Professor Hussey in 1914 and containing the results of work much of which was directly organized and inspired by him, is now on our shelves and the end is surely not yet.

The co-operative arrangement with La Plata University continued for six years. The end was perhaps more dramatic than the beginning. When Professor Hussey left for Argentina in July, 1915, for the fourth time, Mrs. Hussey was not well enough to travel but apparently was not in immediate danger. Unexpectedly her condition became so grave in September, 1915, that Professor Hussey was summoned home—too late as it proved. Old friends met him on his arrival in New York to tell of his loss a week before. It was not practicable to return to Argentina then. The following year conditions in Argentina were most unfavorable. Government revenues were greatly diminished by the great war. Plans for research in Astrophysics to be established by the writer at La Plata could not be financed. It was considered best for the University of Michigan to establish its own station in the southern hemisphere. Professor Hussey remained on the staff of the La Plata Observatory as Director until 1917, continuing beyond that time his efforts in behalf of that institution.

At least twenty-five years ago Professor Hussey set up as a major objective an expedition into the southern hemisphere to search for double stars. This project, woven closely into the rest of his life, colored many of his undertakings. Thus, in the search for "seeing" in Australia in 1903 there was a personal interest with that of the Carnegie Institution. The co-operative agreement with La Plata not only furnished opportunity for immediate results, in that 312 pairs of double stars were found in the southern sky by Professor Hussey with the 433-millimeter Refractor, but it also gave opportunity for a survey of conditions in Argentina. It was more than fifteen years ago, in 1908, that Mr. R. P. Lamont of Chicago, a friend since college days, was ready to finance the plan that Professor Hussey and he had kept in mind for a number of years. Designs and detailed drawings for a telescope mounting began at Ann Arbor in 1910. The contract for a 24-inch lens was placed with the Alvan Clark & Sons Corporation in 1911.

Following the completion of the 37½-inch reflector the construction of the refractor mounting proceeded rapidly to readiness. But the story of the lens was far different. Glass makers in France famous for their successful production of great telescope discs failed repeatedly in their attempts to produce 24-inch blanks. In 1913, Schott and Sohn of Jena joined in the attempt to produce the glass, and finally, when Germany's submarine campaign was at its height, advised that the discs were ready to be shipped at the purchaser's risk. Soon the United States entered the war and the precious glass in these discs was diverted to other purposes in Germany. Attempts then followed in the United States for

four years with little prospect of success. At last in 1922, it was learned that discs of glass exceeding 27 inches in diameter were in the making at Jena subject to order. No time was lost in speaking for them and as little extra work on the mounting was entailed through the increase in contemplated diameter there was at last in the face of heartbreaking delays a real consolation in the prospect of an instrument of signally increased power.

McDowell's work in figuring the 27-inch lens began early in 1923. In October he reported completion approaching. A month later came the wire announcing his tragic death. Professor Hussey learned of this in Africa where he was seeking a site for the new telescope. A year later still the lens in Hageman's skillful hands tested without a flaw. On January 27, 1925, the 27-inch lens arrived in Ann Arbor to prove itself on the stars in its finished mounting. Yet more delay followed through the unwillingness of steel fabricators to accept at reasonable cost a contract for the 56-foot dome needed for the effective use of the telescope. The J. W. Fecker Company, then appealed to, solved this problem by taking the dome contract on a reasonable basis just as the expedition was about to sail. The last letter ever typed by Professor Hussey, written during his final morning in Ann Arbor, concerned this matter.

Ten days later the plans so fully perfected by Professor Hussey fell into other hands. Almost as soon the University of Michigan and Mr. Lamont had united in the determination that they should be carried out. Doctor R. A. Rossiter, waiting in London, was authorized to proceed to Bloemfontein to erect the building and receive the telescope already far on its journey to Africa. With other features of the program provided for, it is expected that scientific results may be secured that will serve fittingly as one of the many memorials that Professor Hussey has left behind him.

Concurrently with the progress of the southern expedition, projects for increased facilities in Astronomy at Ann Arbor were under way. Professor Hussey had practically realized present plans for the equipment of the Astronomical Laboratories on the upper floor of Angell Hall, where a 10-inch refractor, a 3-inch transit and other apparatus are being installed. For some years Professor Hussey had been formulating plans for a new research observatory for the University of Michigan with confident expectation that they would be realized. The present site for whose protection Professor Hussey worked so earnestly becoming untenable by encroachment of railroad, power house and other close buildings, he joined in the selection of a suitable observatory site well removed from disturbing conditions. He planned for this site greatly improved instrumental equipment and counted also on the construction of a research office building and laboratory on the campus at Ann Arbor. Who does not share his confident belief that these plans will soon take form at the University of Michigan?

Honors began coming to Professor Hussey early in his career. In

1903, he was made a Foreign Associate of the Royal Astronomical Society of London. The following year he was made an honorary member of the Mexican Astronomical Society. He was elected President of the Astronomical Society of the Pacific for the term of 1905-1906. In 1906 he received the Lalande Prize of the French Academy for discoveries and investigations of double stars. He was secretary of the American Astronomical Society from 1908 to 1912 and during that time compiled the initial volume of the publications of that Society. He also served two terms on the council of that Society. He received the honorary degree of Sc. D. from Brown University in 1912 and served as president of the Research Club of the University of Michigan for the term 1919-1920. He was a member also of the American Mathematical Society, the Seismological Society of America, the International Astronomical Union, and a Fellow of the American Association for the Advancement of Science.

His publications began to appear early. *Logarithms and Other Mathematical Tables* and *Mathematical Theories of Planetary Motions* (a translation by Harrington and Hussey) together with several technical papers appeared during his residence at Michigan and Stanford Universities. While at Lick Observatory his *Micrometrical Observations of Double Stars Discovered at Pulkowa* appeared as Volume V of the *Lick Observatory Publications,* and in addition he contributed about 130 technical articles to various astronomical periodicals during that time. Subsequently, the total of his technical articles has increased to more than one hundred and seventy. At his death a texbook of trigonometry with extensive tables, completed through intermittent efforts of many years, was largely in page proof, and a textbook of Astronomy that had been on and off his desk for fifteen years was in an advanced state.

As a friend of Professor Hussey, beginning twenty-five years ago when, a novice at Mount Hamilton, I instinctively sought his counsel, there are many things in personal tribute that I would gladly record. His mastery of the technique of precise measurement, his editorial skill, his breadth of vision as manifested in his plans and programs, his untiring energy, his courage through disappointment and adversity—these are well known. But perhaps all of us who were in close touch with Professor Hussey would place first in our tribute to his character the qualities of friendliness, approachability and generosity combined with the strictest standards of honesty and loyalty. Colleague, staff member, student or stranger met a welcome at his office or in his home. They found his time theirs even at the expense of his own program—and often more than his time. The sacrifices of his own college days brought him near to the student in need, who found him sympathetic and eager to help. At Ann Arbor he generously postponed his own research interests when he built a reflector to be used in astrophysical investigations. And these are only isolated manifestations of a spirit

that characterized his life—a spirit that continues to live among us.

No burial stone need be erected in Professor Hussey's memory. There are memorials of his own creation which will live when stones have crumbled away. There are buildings, instruments, volumes of scientific learning across which his name is written. And there is the ineradicable record of a memorable career.

## THE GREAT FIREBALL OF AUGUST 2, 1924.

By CHARLES P. OLIVIER.

On the morning of August 2, 1924, at 1:22 A. M., one of the most brilliant fireballs reported for many years passed over the Bahama Islands, moving from south to north. This object was seen from four American ships which reported their observations, three to the Hydrographic Office, U. S. Navy, and one to the Weather Bureau Office. By the courtesy of these two offices, copies of all such reports are sent to the undersigned, and placed upon the files of the American Meteor Society.

Though on other occasions the same fireball had been reported by two vessels, on the above date for the first time the same object was reported by four. It was hence of great interest to compute the path of this object in the earth's atmosphere and its approximate orbit in space.

The ships reporting were as follows in order of the receipt of the reports by the writer: *S. S. Robin Adair,* Capt. Chas. Smith; *S. S. Concho,* Second Officer J. W. Johanasson; *S. S. Henry D. Whiting,* Capt. R. Blaustein; and *S. S. Topila,* Capt. F. W. Robbins. Grateful acknowledgement is made to each of these officers. The four ships will hereafter, for brevity, be designated in the above order S1, S2, S3, and S4. Their respective positions were reported as 74° 14′ W, 21° 28′ N; 78° 40′ W, 28° 18′ N; 83° 13′ W, 24° 30′N; and 82° 11′ W, 24° 20′ N.

The observations for the altitude and azimuth of the starting point of the fireball were in order:

$h_1=39°, a_1=146°$; $h_2=11½°, a_2=315°$; $h_3=8°, a_3=270°$; $h_4=18°, a_4=276°$.

The same co-ordinates for the end point were:

$h_1=5°, a_1=169°$; $h_2=16°, a_2=315°$; $h_3=8°, a_3=—$; $h_4=15½°, a_4=250°$.

The azimuths are expressed to the nearest whole degree, counting from south through west in the ordinary astronomical sense. The time at which the object appeared was given as 1:25, 1:20, 1:17, and 1:25; average 1:22 A. M., E. S. T.

Everyone realizes that observations of an unexpected object like a fireball are liable to rather large errors, no matter how experienced the observer. Hence we cannot expect perfect accord. The writer, therefore,

after several preliminary efforts, abandoned a rigorous solution, and attempted a graphical one. Plotting upon a chart of the region containing the four ships their respective positions, azimuth lines were then drawn in the observed directions. Had the observations been perfect, these lines would have intersected in two points, which would be the projections upon the earth's surface of the points of beginning and ending of the fireball. Due to unavoidable errors of observation such a result could not be expected. The writer, therefore, after a careful study of the records, had to use his own judgment as to just what points within the areas bounded by the azimuth lines were the most probable. After many trials these points were chosen and the heights were next computed as seen from each ship. The ships were all so distant from the fireball that large additive corrections (amounting to one-half the arc, ship to projected point,) had to be applied before the observed altitudes could be used. Taking the mean of the heights thus derived, the altitudes were recomputed and the observed minus the computed altitudes and azimuths thus obtained for each. The following table gives these differences for both beginning and end.

| | Beginning | | End | |
|---|---|---|---|---|
| | *h* | *a* | *h* | *a* |
| S1 | + 9?3 | 5° | — 7?4 | 5° |
| S2 | — 5.6 | 13 | — 2.4 | 6 |
| S3 | — 3.6 | 3 | — 0.8 | — |
| S4 | + 3.7 | 2 | + 6.5 | 0 |
| Average | 6 | 6 | 4 | 4 |

As these residuals are not unreasonably large for this type of observation, particularly when made upon a moving ship, it is believed that the heights based upon the derived data are near the truth.

The fireball thus entered our atmosphere at a point above 75° 44′ W, 23° 56′ N, and ended over 75° 44′ W, 26° 14′ N. Its first height was 203 km, and having followed a sloping path 263 km long, it ended at a height of 147 km. In other words it started about 100 miles southeast of Nassau and ended about 100 miles northeast of that city. During its flight it must have been easily visible from all the Bahama Islands and their surrounding waters. Assuming as usual a parabolic velocity around the sun, the corrected radiant came out R.A. = 330°, Decl. = —56°, the zenith attraction of 3°.3 having been allowed for. The elements of the corresponding parabolic orbit are:

| | |
|---|---|
| Inclination | 41° |
| Long. Ascending Node | 310° |
| Long. Perihelion | 220° |
| Perihelion Distance | 0.5 |

While the estimates of the time the object was visible differed far too widely to be useful for computing the velocity in our atmosphere, all the observers agreed that the body moved very slowly. Hence our assumption of parabolic velocity doubtless erred on the side of making it too great. This of course amounted to an assumption of velocity of

earth : velocity of fireball : : 0.7 : 1.0. The ratios of 0.8 to 1.0 and 0.9 to 1.0 were then tried, both making the relative velocity slower. But the change in the computed inclination amounted in either case to less than 1°, a negligible quantity in this type of work. We may therefore be confident that the object had direct motion, *i. e.* moved in the same direction as the earth.

All observers reported the fireball of a bright green color, and some reported a tail of sparks following. The brilliancy was compared to daylight from S2, and from S1 it was said to make the tackle on deck plainly visible. The other two ships reported it as brilliant and having an appreciable disc, but they were about twice as distant as the first two, and so the object was low in the sky and not quite so striking.

Altogether we have here an example of one of the finest fireballs on record, and that we can compute its approximate path and so obtain data of much scientific interest is due to the careful observations of the officers already mentioned. It is hoped that the publication of this article will call to the attention of all readers the real importance of such observations and how by a little trouble on their part, when such an object is seen, results of great value to meteoric astronomy may follow.

Leander McCormick Observatory, University of Virginia.

## LUNAR APPULSE, 1926 DECEMBER 18-19.

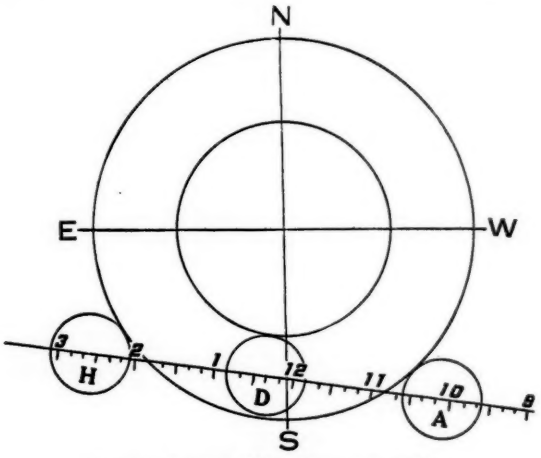
By WILLIAM F. RIGGE.

At 12:20 A. M., Central Time, on December 19 there will be a lunar appulse, well visible all over the United States, when the moon will pass through the earth's penumbra and just miss touching its shadow. There will therefore not be a true eclipse, but as the disk of the full moon will be very unequally illuminated by the sun, from almost full brilliancy at the southern end to almost total darkness at the northern, the sight will be so unusual that it will be well worth observing. Professional astronomers may also seize this opportunity of measuring the varying amount of light and heat on the moon at the time, for which the moon's long oblique path through the penumbra will give them more time than it generally does in eclipses.

The annexed drawing presents the appulse in a graphic form that hardly needs any explanation. The largest circle is the earth's penumbra and the other concentric with it the shadow. The three smallest circles show the moon, at *A* when it enters the penumbra at 10:06 P. M., Central Time, on December 18, at *D* when it is almost tangent to the shadow at 12:20 A. M. on December 19, and at *H* when it leaves the penumbra at 2:35 A. M.

*L'Astronomie* in its last January number, pp. 19-32, has a long and

exhaustive article by Gaetan Blum on the moon's partial or complete passage through the penumbra only, with twelve general deductions drawn from them, or we might say, rules governing them. They are too many and need too much explanation to be quoted here. But in general, as appulses might be called very small negative eclipses, they can occur only when a series is about to begin or has just ended. By series is meant here a number of eclipses, about 40, which succeed each other with the Saros interval of 18 years and 10 or 11 days, gradually




LUNAR APPULSE 1926 DECEMBER 18-19.

| | Central Time |
|---|---|
| A—Moon enters Penumbra | 10:06 P. M. |
| D—Appulse | 12:20 A. M. |
| H—Moon leaves Penumbra | 2:35 A. M. |

growing to a maximum and declining again to zero, such as was illustrated in POPULAR ASTRONOMY, XXXI 506, October 1923, in the article on "The Columbus Eclipse." This particular Columbus series began in 963 April 11 with the magnitude 0.03, rose to 1.82 in 1179, and ended in 1684 with the magnitude 0.06. Therefore 18 years and 10 or 11 days before the first eclipse and the same interval after the last one, a lunar appulse certainly occurred. Of course Oppolzer does not give appulses as they are not true eclipses, but they may be inserted in his list by following a series backward to its beginning and forward to its termination and then extending it by the Saros limit once or oftener. It is plain that the farther one departs from the beginning and end of a series the less closely does the moon come to the shadow. Thus in this appulse of 1926 December 19 the moon is somewhat farther from the shadow, 42″, than it was in 1908 December 7, when it was 15″. It is likely for this reason that the *American Ephemeris* does not give the present appulse, although it did give the former one.

Of course, if one should take the fancy, as Blum does, to tabulate every passage of the moon through the penumbra, and umbra from magnitude about —1.00 to +1.80, he will find from two to four such cases every year. Thus during this year, 1926, there are four of them through the penumbra only, January 28, June 25, July 25, and December 19, in which the moon dips into the penumbra the fractions respectively 0.55, 0.67, 0.35, 1.02, of its diameter.

With the *Ephemeris* at hand it is easy enough for an amateur to find all the data that he needs for his graphic construction and even for his numerical computation. To determine whether and when such a passage of the moon through the penumbra will take place, all that is necessary is to find the celestial latitude of a Full Moon and compare it with the radius of the penumbra plus the moon's semidiameter, that is, with the sums of the parallaxes and the semidiameters of the sun and moon.

Such investigations may be of theoretical interest, but they have a practical value only when the moon's approach to the umbra is a close one. Although even in this last case they are for the public at large only rare astronomical curiosities, they are however well worth seeing for this reason.

## A SOPHOMORE DETERMINES THE SUN'S DISTANCE.

By SERGE A. KORFF.

An approximate measurement of the distance of the sun was accomplished as here outlined, by a college sophomore. The determination was of a fundamental nature, assuming nothing except the velocity of light and the correctness of Rowland's wave-lengths of spectral lines. The observations form a very interesting exercise, which may prove attractive to other students.

This exercise may be outlined as follows: The measurement of the Doppler shift of Fraunhofer lines, taken with a spectroscope of moderate power between opposite limbs at the sun's equator, gives the sun's rotational speed in kilometers per second, assuming the speed of light as $3.00 \times 10^5$ km/sec. The period of the sun's rotation is observed telescopically by following sunspots across its disk. From these two sets of observations the sun's diameter in kilometers is readily computed; and, measuring the angular semi-diameter with a sextant, the sun's distance in kilometers is found.

The measurement of the Doppler shift was made, in the first instance, from spectrograms of the sun at different latitudes which were obtained from the Mt. Wilson Observatory (their standard photograph, furnished under the designation C-15). The Doppler shifts were

measured in millimeters with a small scale and magnifying glass. When plotted against the solar latitude the average of the measured shifts was found to approximate a cosine curve of amplitude 0.48 mm, corresponding to the Doppler shift at the sun's equator. (These measurements could be made within about 10%.) On the scale of the photograph, this represented a wave-length change, $\Delta\lambda$, of 0.057 angstrom. From the formula for Doppler shift,

$$V/C = \Delta\lambda/\lambda,$$

where $V$ is the velocity of the source, and $C$ that of light; and writing $\lambda = 4285$ (about), the double rotational velocity at the sun's equator came out 4.0 km/sec.

The average shift used in this calculation was the mean of the equatorial shifts for the following lines on the Mt. Wilson photograph:

| Element | Wave-Length | Distance in millimeters from left edge of picture |
|---|---|---|
| Cr | 4274.958 | 53 (strong) |
| Fe | 4282.565 | 113 (strong) |
| Ti | 4287.566 | 154 (faint) |
| ? | 4288.888 | 163.5 (faint) |
| Fe | 4291.630 | 187 (strong) |

The next problem was to obtain the period of the sun's axial rotation. The position of the spots on the sun's disk (projected with the 3-inch finder of the 9½-inch equatorial refractor) were plotted over about two months, and two of the spots were seen to reappear after a complete revolution. The synodic period of solar rotation thus obtained was 28 days. The synodic rather than the sidereal period was employed, since the synodic Doppler shift was used.

The observations of the spots also gave, of course, an approximate position of the sun's equator.

The diameter of the sun at an intermediate date was obtained by sextant measurement as 34′ 20″. This is the apparent arc subtended. The actual circumference must be 28 (days) × 24 (hours) × 3600 (seconds) × 2.0 km. This is the distance the spot on the surface travels in one rotation. Assuming the sun to be a sphere, its diameter is this distance divided by $\pi$, or 1,540,000 km, or 955,000 miles. Since 34′ 20″ is 0.010 radian, the solar distance is thus given as about 95,000,000 miles. The largest error is introduced in the measurement of the spectrograms. (The best standard determinations give for the mean distance of the sun 92,870,000 miles.)

We have here a method for a fundamental measurement of the sun's distance, the accuracy of which is only limited by the amount of care taken in making the observations. None of the observations are difficult, or out of the range of the average student's facilities. It is a striking fact that a measurement of a half-millimeter shift in the spectrogram gives a clue to a distance of nearly a hundred millions of miles.

*Extension of the Exercise.*

It was found possible to obtain a rough direct measurement of the Doppler shift with a grating spectroscope attached to the 9½-inch refracting equatorial telescope of the Observatory of Instruction at Princeton University. A long series of micrometer measures, in the third order with a grating of 17,000 lines per inch, gave the shift with about 10% accuracy.

The method was to measure the shifts of the solar lines relative to the telluric lines, at opposite limbs on the sun's equator. (The position of the sun's equator had been determined by the observation for rotation period.)

The following lines were chosen (with Rowland's wave-lengths):

| Solar Lines (Iron) | Telluric Lines |
|---|---|
| 6302.209 | 6302.209 |
| 6301.719 | 6296.170 |
| 6298.007 | 6295.389 |
| 6291.184 | 6293.170 |
| | 6292.374 |

These lines are rather faint, but well suited for the purpose. The small scale Mount Wilson photographic sunspot map is of aid in identifying them, as the telluric lines are not distorted over the sunspots as are the others. The shift is very small, and a large number of observations are needed for accuracy. The measurements were made with a micrometer eyepiece attached to the spectroscope, having a movable crosshair controlled by a screw—the calibration of which had to be found from the observations.

The determination of the sun's distance by the method here described would be made completely independent of constants determined by other observers if measurements were included of the wave-lengths of the spectral lines employed—as could be done without difficulty with a spectrometer or interferometer; and by measuring also the speed of light. For the latter purpose, Foucault's apparatus, employing a rotating mirror, is available in some laboratories.

All the observations described above were made during the spring of 1926.

Princeton University, June, 1926.

## THIRTY-SIXTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY.

[*Continued from page 558.*]

### GYROMAGNETIC ELECTRONS AND A CLASSICAL THEORY OF ATOMIC STRUCTURE AND RADIATION.

By Louis Vessot King.

A charged sphere in rotation was shown by Maxwell as long ago as 1870 to give a uniform internal field, and an external field equivalent to that of a magnetic doublet. The writer has considered the problem of determining the fields due to a spinning electron moving with uniform velocity $v$ making any direction with the axis of spin, taking into account the deformation or contraction of the electron boundary into an ellipsoid of axes $a$ and $a(1-v^2/c^2)^{\frac{1}{2}}$, the short axis being in the direction of motion. Regarding this as a real, physical deformation, the energy of the electrostatic and magnetic fields, internal and external, separates into two terms, one translational, the other due to components of spin $(\omega_1\omega_2\omega_3)$. The final result is

$$T = mc^2 + \tfrac{1}{2}(A\omega_1^2 + B\omega_2^2 + C\omega_3^2) + constant \qquad (1)$$

In the first term, $m = m_0/(1-v^2/c^2)^{\frac{1}{2}}$, where $m_0 = \frac{2}{3}(e^2/a)$, and account is taken of the boundary stresses (probably magnetic in origin) which keep the electron in equilibrium. The electrodynamic moments of inertia may be rigorously evaluated for the simple type of spinning electron considered, and in general may be expressed in powers of $\beta^2 = v^2/c^2$ in the form

$$A = I(1 + a_1\beta^2 + a_2\beta^4 + \ldots),\ B = C = I(1 + c_1\beta^2 + c_2\beta^4 + \ldots) \qquad (2)$$

where $I = \frac{1}{3}(m_0a^2)$ is the moment of inertia of the spinning electron at rest. Applying Lagrange's equations to the rotations expressed by $T$ as kinetic energy, the precessional motion of the electron is determined by Euler's equations,

$$\begin{aligned} A_1\dot{\omega} = L_1 \qquad & C\dot{\omega}_2 - (C-A)\omega_1\omega_3 = L_2 - Ck\omega_2 \\ & C\dot{\omega}_3 + (C-A)\omega_1\omega_2 = L_3 - Ck\omega_3 \end{aligned} \qquad (3)$$

$(L_1L_2L_3)$ being couples from nuclei in atomic systems, or due to the magnetic forces of the radiation field. The precessing electron has magnetic moments proportional to $(\omega_1\omega_2\omega_3)$ whose periodic variations thus give rise to electromagnetic radiation of the same frequency. The constant $k$ is a simple type of damping factor due to the loss of rotational energy by radiation. Under no forces the stable configuration of the electron is easily seen from (3) to be with the axis of spin along

the direction of motion. When disturbed the frequency of precessional motion and of emitted radiation is seen to be, if $\Omega_1$ is the intrinsic spin,

$$2\pi\nu = \Omega_1(C-A)/C = \Omega_1(c_1-a_1)\beta^2(1+b_1\beta^2+b_2\beta^4+\dots) \quad (4)$$

If we denote

$$h\Omega_1 = \pi c^2 m_0/(c_1-a_1), \quad (5)$$

where $(c_1-a_1)$ is a numerical constant equal to $2/5$ for the simple model considered, we have to a first approximation a relation between *precessional electron radiation* and *velocity* in the form

$$h\nu = \tfrac{1}{2}m_0v^2, \quad (6)$$

the well-known photo-electric equation, while *Planck's constant h becomes a fundamental characteristic of a rotating electron expressed in terms of spin by equation* (5).

This purely classical interpretation appears to be the key to radiation problems generally. With similar hypotheses as to spinning protons as constituents of atomic nuclei, the theory of slightly perturbed, simple orbits under an inverse-square law of electrostatic attraction from the nucleus, with the fundamental relations (6), leads to the series formula for hydrogen and helium spectra and in more complex cases to the S,P,D and F series, with the correct value for the Rydberg constant. Perturbations of orbits due to variation of mass with velocity, external electric and magnetic fields, with in some cases slightly different interpretations, lead to formulae of the correct type for fine structure, Zeeman (normal and anomalous) and Stark effects. The fundamental formula (6), used in conjunction with a Maxwellian distribution of electron velocities, also leads with reasonable hypotheses as to electron orbits in a space lattice to Planck's formula for blackbody radiation and the associated formulae for specific heats.

## PLANETARY RADIOMETRIC OBSERVATIONS.

By C. O. Lampland.

The present statements on planetary radiometric observations are given as a brief report of progress on work extending considerably the measures on several of the planets, chiefly Mercury, Venus, the moon, and Mars, and including also observations of several stars of different spectral types to supplement the planetary data.

Planetary radiometric investigations have now reached the stage where the need for systematic work is obvious. The necessity for systematic work on a planet like Mars should have been anticipated, and indeed the importance of extended observations was strikingly brought out in the post-opposition measures on that planet in 1924, the measures showing clearly the great rise in temperature and increase in energy received from the south polar zone at the time of the summer solstice of the southern hemisphere.

The instrumental equipment is being improved as rapidly as possible

to facilitate measures of different kinds. More convenient mountings of the secondary mirrors, and the double slide carriers for the radiometer, now permit the change of mirrors giving different equivalent focal lengths to be made in a short time, a matter of some importance for the most effective radiometric work. A welcome addition to the energy gathering power of instrument has come from enlarging the diaphragms of parts of the mounting of the telescope, permitting the great mirror to work at its full aperture of slightly more than 42 inches. It should be explained that the mounting was designed and constructed for a 40-inch mirror, but the glass received for the mirror made possible the figuring of one of 42 inches. We owe it to the optician, Mr. C. A. R. Lundin of the Alvan Clark & Sons Company, that the maximum size of the mirror was made from the disk. The necessary changes in the mounting were made the past year.

Where systematic radiometric measures on the planets are needed the work will no doubt fall largely to instruments of moderate size. The need is felt for radiometric apparatus of higher sensitivity and of dependable and practical working efficiency for some of the problems. Those who are familiar with these problems and who know the wonderful performance of the equipment designed and constructed by Dr. Coblentz will realize the difficulties to be overcome. But the outstanding problems should stimulate further efforts in carrying forward a branch of research so important for the advancement of some of the problems of modern astronomy.

## THE VARIABLE NEBULA N. G. C. 2261.

By C. O. Lampland.

The variable nebula N. G. C. 2261 has been observed systematically with the Lowell reflector during the past ten years. The behavior of the nebula for several years after beginning work on it suggested that some regions were not subject to change. Continued observations have, however, shown definitely that the entire nebula has at one time or another undergone change, all the way from slight dimming to complete obliteration of the detail. The observations indicate that the apparent changes are not due to actual displacements or motions of parts of the structure of the nebula. In photographs separated by intervals of months or years it is remarkable the perfect identity or correspondence of the complex and delicate detail of the nebula. In the meantime some of the details in question have been completely wiped out or very much dimmed in brightness and changed in form. In some pairs of photographs of different dates examined in the comparator one gets the impression of great displacements of the structure, and with a limited numbed of photographs erroneous interpretations might easily result from examinations or measurements. The evidence of the long series of photographs made here seems to indicate pretty definitely that we are not dealing with actual displacements of the nebular structure; the

"stuff" forming the nebula evidently remains fixed in place. The apparent changes in the nebular detail appear to be most readily explained through variable effects of illumination (or excitation) by the nucleus.

The spectrum of this nebula is remarkable and of unusual interest. Slipher's observations showed that the nucleus and the outlying nebulosity have the same spectrum and his interpretation was that the nebulosity shines by reflected light from the nucleus. This interpretation appears to be perfectly in harmony with the direct photographic observations of the nebula. But further spectrum observations are now especially desirable, particularly with the view to determine if effects of excitation of the outlying structure are produced by the radiation, or other possible fields of influence, emanating from the variable star at the apex of the nebulosity. It may be mentioned that the spectrum of this object strongly resembles that of a nova in the early stages, particularly that of Nova Aurigae. The transitory character of the early spectra of novae would suggest that the spectrum of N. G. C. 2261 may be subject to change and it would be interesting to know if the spectrum of the nebulosity follows closely the changes in the nucleus and also if the nebulosity in any parts has emission lines of its own. In the spectrum photographs thus far obtained no indications have been found of the nebular lines typical of gaseous nebulae.

## MOTIONS IN THE ATMOSPHERE OF $\eta$ AQUILAE.

By David W. Lee.

About seventy selected lines of the spectrum of $\eta$ Aquilae were divided into seven groups according to their height in the chromosphere of the sun as determined by Mitchell. The first group of lines corresponds to solar chromospheric heights, 300 to 550 km, the second 600 to 750, the third 800 to 900, the fourth 1000 to 1200, the fifth 1300 to 1600, the sixth 5000 to 6000, and the seventh 8000.

The mean radial-velocity curve, using lines from all levels, was formed and a secondary variation on the ascending branch was confirmed. Seven velocity-difference curves were formed by subtracting the mean velocities obtained from all lines from those of each group. Systematic differences indicate a gradual increase in the general lag of phase at higher levels.

Lines due to the ionized atoms were then separated from those due to the neutral atoms. Special features of the three velocity-difference curves from neutral atoms for levels two-minus-one, three-minus-two, and four-minus-three suggest the progress of a compressional wave upward through the atmosphere. A maximum and a minimum occur in the first curve at phases —0.5 and 1.5 days respectively. The same features are evident about one day later in the second curve and two days later in the third. They could not be traced at higher levels.

Velocity-difference curves, ionized minus neutral, were formed for the level-groups in which both kinds of lines are found. The first, sec-

ond, and third groups show accordant systematic features. These also agree with the results obtained from the differences between the mean of the ionized at all levels and the mean of the neutral at all levels. A well-established maximum precedes light minimum about one-half day and a corresponding minimum precedes light maximum by the same length of time. A pause on the ascending branch is also characteristic. The striking resemblance of this velocity-difference curve to the radial-velocity curve cannot fail to attract attention.

Assuming that these features are Doppler effects and adopting an arbitrary zero a circulation of the ionized atoms with reference to the neutral has been observed with maximum fall near the time of minimum ionization, as found by Henroteau and confirmed by preliminary work by myself, and a maximum rise of the ionized atoms near the time of maximum ionization. These features precede light minimum and light maximum respectively by about one-half day.

Support is evidently found for the radial pulsation theory of Cepheid variation supplemented by atmospheric pulsation.

## PLANETARY TIDES AND SUN-SPOTS.

By Hazel Marie Losh.

In *L'Astronomie* for November, 1925, M. Jean Malburet has discussed the possible relation between the eleven year sun-spot period and the syzygies of the planets. He finds that for a long period of time the maxima of the sun-spot curve have been synchronous with the heliocentric conjunctions or oppositions of Jupiter, Venus, and Earth, and concludes that the sun-spot activity is due to the tidal forces of these planets.

The combined tide-raising force on the sun of all the planets is very small, approximately one thirty-thousandth of the effect of the moon on the earth. It is inconceivable that changes in sun-spot activity could be caused by variations in such a small force, unless the force of gravitation on the sun is balanced by radiation pressure. According to the recent work of Milne and others, such a balance of forces is not improbable, and therefore a quantitative study of the tidal forces of the planets on the sun was undertaken.

The mean tide-raising forces of the planets vary directly as their masses and inversely as the cubes of their mean distances from the sun. The relative tidal forces of the planets are, therefore, Jupiter, 2.3; Venus, 2.2; Earth, 1.0; Mercury, 1.2; Saturn, 0.1; Mars, Uranus, and Neptune, 0.0. The maximum tangential and radial components, due to the combined action of Jupiter, Venus, Earth, and Mercury, were determined at intervals of thirty days from the beginning of the year, 1914, until the sun-spot maximum in 1917. These values were plotted and compared with the sun-spot curve for the same period of time. The tidal forces on the whole show no relation to the sun-spot activity. Their most outstanding feature is a four-month period, corresponding

to the conjunctions and oppositions of Jupiter and Venus. No such period has been found in sun-spot activity.

Since the curve of M. Malburet was based on the three planets, Jupiter, Venus, and Earth, the radial components of the tide-raising forces of these three planets were computed for all their close syzygies during the past sun-spot cycle, 1913-1923. There is little variation in the actual tidal forces at the syzygies of Jupiter, Venus, and Earth, even when the intervals vary from zero to twenty days.

The planetary tides are always present on the sun. Their principal variation, due to Venus, has a period of four months with an average amplitude of fifty per cent. The variation with a period, approximately that of the sun-spots, is of the order of five per cent. It seems entirely improbable that this small variation should produce the total range in sun-spot activity, when the much larger variation with a period of four months produces no effect on the number of sun-spots.

## A SPECTROGRAPHIC STUDY OF λ TAURI.

By Dean B. McLaughlin.

This discussion is based on 91 single-prism spectrograms taken at Ann Arbor. The Allegheny curve by Schlesinger, corrected by elimination of rotation effect, was adopted as a standard for the redetermination of the velocity variation due to a third body. The observations satisfy a period of 30 days much better than that of 34.6 days determined at Allegheny. The Allegheny observations will not conform to the 30 day period.

The rotation effect as measured on the Ann Arbor plates appears to have an amplitude of 6.4 km, but some of the observations are very discordant. This rotation effect indicates a mass which is very small for a B3 star. The measures are probably affected by blends due to secondary lines.

Faint companions are frequently observed on both sides of the hydrogen lines at all phases, but they appear most frequently in such positions that they may be interpreted as secondary lines. It is believed that the observed effects are due to the periodic blending of faint secondary lines with faint absorption borders which flank a very indistinct emission band. The range of velocity indicated by these suspected secondary lines gives a mass which is closer to that we should expect for a class B3 star. The two sets of dimensions are given below:

| | Rotation Effect | Secondary Lines |
|---|---|---|
| Radius of bright star | 3.30 ⊙ | 5.35 ⊙ |
| Radius of faint star | 2.48 | 4.00 |
| Mass of bright star | 0.70 | 3.71 |
| Mass of faint star | 0.47 | 1.24 |
| Density of bright star | 0.019 | 0.024 |
| Density of faint star | 0.031 | 0.019 |

The linear dimensions may be as much as 25 per cent greater than those given in the last column.

## VARIABLE HYDROGEN AND HELIUM LINES IN THE SPECTRUM OF BETA LYRAE.

By Antonia C. Maury.

A cyclical variation of great range is found in the dark lines of hydrogen and helium of the B3e secondary, and one of lesser range in those of the cB9 primary. These changes, together with the well-known fading of the bright bands of hydrogen and helium, alternately on the blue and red sides of their dark central reversals, appear to depend on the changing position of the revolving ellipsoids with regard to each other and the line of sight.

As the bright bands of the emission star are always toward red when that star is receding, and toward blue when it is approaching, it seems clear that they are emitted by the outer limb, which is rotating in the direction with the revolution, and are neutralized on the inner limb by some irradiation effect of the intensely bright and very close primary.

The bright bands, also, are stronger in recession than in approach. They are very bright during the first half revolution, when they are toward red, and fade to less than a tenth of their normal intensity in the latter half of the period, when they are toward blue. Also some persist faintly on the inner limb when it is receding, but scarcely at all during its approach.

A high maximum is reached by both bright bands and dark lines at about 0.5 days, a rapid rise following the primary mid-eclipse. The spectrum of the B3e star is then dominant, since this star is in front; but the maximum is not due to this fact alone, since the lines are weak during the entire first half of the eclipse. The rise, however, probably occurs in the lines of the B3e star.

The bright bands widen and fade, slowly during the first half of the cycle and rapidly during the second half, becoming nearly invisible on the eleventh day of the 12.9 days period.

The dark lines of both stars fall to a minimum of intensity at both times of greatest radial velocity of the binary. The spectrum of hydrogen and helium then appears as pairs of fine equal lines having a combined intensity less than a third that of the strong lines of the zero days maximum. The normally dense lines of the B3e star are now as sharp and narrow as those of the c type primary, while the faintness of both spectra is extraordinary. The bright bands have spread so as to suffuse the dark lines.

A second and lower maximum occurs in the lines of the primary toward the end of the period. The K line and the enhanced lines of iron and titanium take part in this increase as well as those of hydrogen and helium. It is clear that the dark lines of both stars as well as the bright bands of the secondary are stronger in recession than in approach.

It appears likely that the maxima and minima may be in the main pre-

sentation effects. If we suppose the long axes of the ellipsoids nearly but not quite aligned as they revolve, we find that the maxima of intensity occur when the ellipsoids are seen end-on, the line of sight passing parallel to the long axis, along the outer and receding limb of the respecting stars, and that the minima occur when the long axes are normal to the line of sight, which then crosses the narrow tip of the outer limb. The difference may be due to the longer or shorter stratum of atmosphere through which the line of sight is passing.

A secondary variation exists, causing phase acceleration or phase delay in different revolutions, with range of about a day and period as yet unknown. It might be explained if the long axes of the ellipsoids oscillated from side to side of a true alignment.

## THE SUMATRA ECLIPSE.

By John A. Miller.

The paper discussed briefly some of the outstanding features of the corona of 1926. The inner corona is full of complex detail. It was very bright and the boundary between it and the outer corona very definite, but very irregular. There are numerous arches resembling those of 1918, others that resemble more those of 1923, and one set of arches just beneath the large coronal spike in the northwest quadrant of the sun, differs in many particulars from either. The disturbed regions of the corona do not seem to appear adjacent to regions of the solar surface (as they did in 1923) that show either spots or flocculi on $K_2$ spectroheliograms made at Mount Wilson on days preceding and following the eclipse. The outer corona is made up of long, graceful streamers, much more regular than the streamers in comets' tails. The shape of the corona is that that characterizes a maximum sun-spot period.

## A STUDY OF SOLAR MOTION BY HARMONIC ANALYSIS.

By J. J. Nassau and P. M. Morse.

A method of obtaining the solar apex and velocity by graphical-harmonic analysis is here presented, which, it is claimed, excels Airy's least-squares method in its simplicity, ease, and adaptability to data available. The theory of analysis is discussed, and its further possibilities in the study of stellar parallaxes and group motion are indicated.

To demonstrate the method, the radial motion of 476 stars was obtained from the *Publications of the Dominion Astrophysical Observatory*, Vol. II, No. 1, and their corresponding proper motion, from Boss' *Preliminary General Catalogue*. From these, the solar apex was determined with the following results:

$$A = 272°, \quad D = 33°.7, \quad V = 24.8 \text{ km/sec.} \quad \pi_{av} = ''.0092.$$

To show the relative accuracy of the harmonic analysis and the least-

squares analysis, the radial velocity of 60 stars of declination about 60° were used, which gave, by harmonic analysis,

$$A = 266°, \quad D = 41°.5, \quad V = 20.5 \text{ km/sec.}$$

By least-squares,

$$A = 256°, \quad D = 60°, \quad V = 17.3 \text{ km/sec.}$$

Inasmuch as the above method is the outcome of the investigation of the treatment of the recent data on the ether-drift experiment (*Science*, April 30, 1926), a discussion of the method is given.

## RESIDUAL INTENSITIES FOR THE SPECTRUM OF γ CYGNI.

By Cecilia H. Payne.

1. The present paper contains some preliminary results of the measurement of residual intensities at the centers of the lines of γ Cygni. It is a continuation of a paper presented at the meeting of December, 1925, and containing the wave-lengths and identifications of four hundred and seventy lines in the spectrum of this star.

2. The construction of a standard scale for the measurement of line intensities has been discussed by Payne and Shapley in *Harvard Reprint*, 28, 1926, and the procedure is here somewhat modified by combining all the points determined from four spectra of known intensity ratio in one reduction curve.

3. Depths of lines derived from spectra of the same star made with one and two prisms have been compared. There is no systematic difference for the two dispersions used (one and two 16° prisms).

4. The central intensities are determined from the reduction curve as difference between residual intensity and line center, expressed in stellar magnitudes.

5. An appropriate unit for the expression of line intensities is the product of the width of the line and the percentage drop from background to line center, summed, for very wide lines, in strips of equal wave-length. These units would be convertible to relative energies if the energy distribution in the background were known.

6. The central intensities of unblended lines of the same multiplet of any one atom are smaller, and the "line depths" in the sense background intensity *minus* central intensity consequently greater, the greater is the laboratory intensity of the line, as would be expected. All unblended components of known multiplets examined show the effect.

7. The central intensities of lines are smaller, the greater the height to which the line is found to reach in the chromosphere, as observed by Mitchell.

8. The greater the solar widening of the line, as observed by Moore and Russell, the smaller is the central intensity of the line.

9. The residual intensities of unblended lines of known series rela-

tions are strongly correlated with the fractional concentrations of the corresponding atoms, as calculated from the formulae of Fowler and Milne, with the addition of a term, derived by the author, for the relative abundance of the corresponding element.

10. Sections 6 to 9 indicate that the depth to which a line cuts into the background depends on the number of the corresponding atoms in the atmosphere—that is, line depth appears primarily to be an abundance effect.

11. The lines 4215 and 4077 of $Sr^+$ show abnormal behavior, such as has been observed for this element in other connections.

## THE ORBITS OF THE SPECTROSCOPIC COMPONENTS OF THE O-TYPE STAR H. D. 19820.

By J. A. Pearce.

The line-of-sight variability of H. D. 19820, $\alpha = 3^h\ 06^m.2$, $\delta = 59°\ 11'$ (1900), magnitude 7.09, spectral type O8, has not been announced heretofore. Twenty-two spectrograms obtained between October, 1925, and April, 1926, were measured for the determination of the orbital elements. The principal results of the investigation are as follows:

1. The spectral type, classified as B5 in the Henry Draper Catalogue, is found to be O8, the spectrum containing the characteristic O-type lines of ionized helium, nitrogen, and silicon.

2. The lines of the brighter component are of good quality, and admit of accurate measurement. The secondary spectrum is much fainter and is measurable only when the relative separation exceeds 200 km, which occurred on fourteen of the plates. The respective probable errors are ±2.4 and ±10.2 km.

3. Corrections were obtained by least-squares for the six elements of the brighter component. Considering these as fixed the semi-amplitude of the secondary component was then deduced. The elements are:

| | | |
|---|---|---|
| $P$ = | 3.36897 | ±0.00028 days |
| $e$ = | 0.1019 | ±0.0078 |
| $\omega_1$ = | 300°.78 | ±3°.31 |
| $\omega_2$ = | 120°.78 | ±3°.31 |
| $T$ = | J. D. 2,424,426.7049 | ±0.0378 days |
| $K_1$ = | 141.65 | ±1.01 km |
| $K_2$ = | 291.75 | ±3.34 km |
| $\gamma$ = | −4.19 | ±0.69 km |
| $a \sin i$ = | 19,975,000 km | |
| $m_1 \sin^3 i$ = | 18.88 ⊙ | |
| $m_2 \sin^3 i$ = | 9.17 ⊙ | |

4. The calcium lines are sharp, and yield a constant velocity of −14.6 ± 0.58 km. Applying the correction for the solar motion, the Hartmann cloud is found to have a space velocity of −12.6 km. This is in good agreement with the space velocity −14.6 km, the mean for eight stars in this region observed here.

5. The star has a decidedly ruddy appearance on the slit, as if it had an abnormal colour index. The violet end of the spectrograms are weak unless an allowance of three-quarters of a magnitude is made in the exposure time.

6. The mass of the system is normal but the mass ratio is smaller than the average value for stars of this class.

7. Assigning to the brighter component a temperature of 29,000° K, a density of 0.01 and a surface brightness of —3$^{M}$.96 with respect to the sun, the computed absolute magnitude is —4$^{M}$.57, yielding a hypothetical parallax of 0″.00039, or a distance of 2560 parsecs. The star is therefore more luminous and more distant than the average O-type star.

## A GENERAL HYPOTHESIS OF STELLAR VARIABILITY.

By C. D. Perrine.

At the Hanover meeting of the Society in 1924 I presented some evidence of dependencies of variability upon brightness and length of period. Subsequent investigation has shown that these relations are not linear but that they are local and periodic, producing greater variability at certain periods. It further developed that different types of variability, including spectroscopic binaries and the supposed eclipsing stars, showed strongly marked preferences both of variability and numbers for *different* periods. This peculiarity is especially marked in the Cepheid and Algol stars which are almost perfectly complementary in their preferences for periods and differ as widely and systematically in their amounts of variability and velocities at different period phases as they do in their light-curves. Obviously therefore the length of period is an important factor in determining the type of variation, including the spectroscopic binaries.

A search for the mathematical relation of these critical periods led to the discovery that in all classes they can be arranged in several sequences the terms of which are connected by the factor 2. The behavior of these sequences is very much like the series found in spectral lines and they are undoubtedly due to wave motion in the one case as in the other.

A study of the forms of the light-curves of the very short period stars showed significant relations to the length of period, further confirming the preferences for certain periods, and suggesting the mechanism by which these preferences were arrived at—the partial or total suppression of variability, whether of light or velocity, at the intermediate periods. A more detailed study of the light-curves of the Cepheids shows unmistakable evidence of the compounding and interference of wave motions.

The behavior of all of these stars with respect to these relationships and to each other logically requires a common underlying cause.

Oscillation furnishes a satisfactory explanation but it is evident that pulsations of a single shallow layer will not satisfy the observed conditions. If, however, we assume differential oscillations in an extensive atmosphere we can account for all of the observed conditions and types including preferences for certain periods and the halving phenomena. Altho pure wave motion seems adequate to account for the observed facts, pressure is certain to be present to some extent and may require to be taken into account.

The evidence leading to these conclusions is too extensive to be given here but is being published elsewhere.

To meet the observed conditions, especially the period-relationships, the following general outlines of an hypothesis are given based upon wave motion and differential oscillations in an extensive atmosphere.

All variability is due primarily to pulsation which takes place in an atmosphere or envelope outside the true photosphere.

The changes are from long to short-period and from "late" to "early" types of spectra.

This envelope is composed largely of cosmical matter. In the "late" types the envelopes are extensive and the temperatures low. As the envelopes condense and progress toward the "early" types the temperature of the inner portion rises more rapidly than the outer and differential oscillations are set up. As a consequence the portions of the envelope giving rise to absorption and to the principal light radiation change their phases. These changes of phase give rise to the different types of variability and to greater variation at certain periods. The pulsations decrease in period and intensity to final extinction. In the long-period and Algol variables the different effective layers are helping each other, whereas in the Cepheids they are in general opposing.

The spectroscopic binaries are those in which the resultant is sensibly constant light but the absorption layer is in oscillation. They are probably related to ordinary light variables at their "nodes."

The pulsations have been set up by sudden accretions of cosmical matter. They are of a series or harmonic type, reaching a maximum at periods of 300 to 400 days. From that maxima they decrease in period and amplitude to periods of about 150 days when "short-period" characteristics set in, *i. e.* change of spectrum from "late" to mid-type and a change in light-curve. At periods of 30 to 40 days changes of phase coupled probably with density and extent of atmosphere, differentiate the Algol stars and the $\beta$-Lyrae stars, the latter being near critical periods or "nodes."

## THE ORBIT OF THE SPECTROSCOPIC BINARY H. R. 4535.

By R. M. Petrie.

The star H. R. 4535 was discovered to vary in radial velocity from measures of two spectrograms made in 1923 which gave a range of 45 km/sec. A number of spectra were taken in the spring of 1926, the

observational data for the determination of the orbit consisting of 21 plates, including the two aforementioned.

The Harvard classification gives the spectral type as A2 and the photographic magnitude as 6.01. The lines are very good for that type of star, admitting of quite accurate measurement.

The preliminary elements, obtained graphically, were corrected by the method of least-squares. All the observations were treated separately and all were given equal weight. As the period was short this element was not included in the solution as the old observations were presumed to fix it with sufficient accuracy. The orbit is nearly circular, considerable uncertainty being felt in regard to the longitude of periastron and naturally the time of periastron passage also.

The elements of the orbit are given below, the probable error of a plate being $\pm 1.53$ km/sec.

$$
\begin{aligned}
P &= 2.7818 \text{ days} \\
e &= 0.018 \qquad \pm 0.018 \\
\omega &= 61^\circ.75 \qquad \pm 23^\circ.88 \\
\gamma &= -24.21 \qquad \pm 0.40 \text{ km/sec.} \\
K &= 30.97 \qquad \pm 0.50 \text{ km/sec.} \\
T &= \text{J. D. } 2{,}423{,}521.231 \pm 0.183 \text{ days} \\
a \sin i &= 1{,}184{,}500 \text{ km} \\
m_1^3 \sin^3 i/(m+m_1)^2 &= .009 \odot
\end{aligned}
$$

## ULTRA-VIOLET SOLAR RADIATION AND ATMOSPHERIC OZONE.

By Edison Pettit.

Measurements of the ratio of the ultra-violet solar radiation transmitted by silver, to the green radiation transmitted by gold, described at the last meeting of the Society, have been continued at Mount Wilson on every clear day. Since presenting this paper to the Society, it was found that the green celluloid filter, used between the gilded lens and plate to narrow the transmission band of gold, was becoming denser. This has been removed and the observations corrected for this effect. It has been found that the celluloid is unnecessary, and it will not be replaced.

Table I shows the march of the ultra-violet radiation, in the second column, compared with the solar constant and number of sun-spot groups in the third and fourth columns.

Table I.

| Date Month Ending | Ultra-violet Solar Radiation | Solar Constant (Abbot) | Number of Spot Groups | Ratio $\frac{\text{No Atm.}}{\text{One Atm.}}$ |
|---|---|---|---|---|
| 1924 June 30 | 1.00 | 1.923 | 1.7 | 2.04 |
| Sept. 30 | 1.10 | 1.920 | 2.1 | 2.14 |
| 1925 Mar. 31 | .... | ..... | ... | .... |
| June 30 | 1.34 | 1.926 | 3.8 | 2.00 |
| Sept. 30 | 1.33 | 1.933 | 4.9 | 1.96 |
| Dec. 31 | 1.49 | 1.934 | 6.7 | 1.94 |
| 1926 Mar. 31 | 1.40 | 1.929 | 6.1 | 1.95 |
| June 30 | 1.31 | 1.922 | 5.6 | 2.09 |

The quantities given here are three-month means for the ultra-violet radiation measurements reduced to no atmosphere, the solar constant and sun-spot numbers. At the present time there appears to be considerable correlation between the three variables, an increase in solar constant and sun-spot numbers being accompanied by an increase in ultra-violet radiation. It will be noted that the falling off in the solar constant and ultra-violet radiation since the beginning of the year has been greater than that of the spots. The peak in the ultra-violet radiation was reached in November and the minimum for the past year in July, 1925, when the values were 57 per cent and 24 per cent, respectively, greater than in June, 1924.

That atmospheric ozone does not affect the ultra-violet radiation determinations was shown in the following manner. A glass tube with quartz windows was filled with ozone and placed in the light-path of the ultra-violet solar radiometer. The amount of the ozone was varied by changing the pressure in the tube. This experiment shows that if the atmospheric ozone were increased 100 per cent, the ratio of ultra-violet to green radiation decreases only 5 per cent, and if all the atmospheric ozone were eliminated the ratio would increase only 3 per cent.

That the atmosphere in general plays a negligible part in the observations is shown in the fourth column, Table I. These values give the ratio ultra-violet solar radiation for no atmosphere to one atmosphere, respectively. It will be noted that this ratio is sensibly constant, in other words, it makes little difference in the discussion of the ultra-violet variation whether we use the values at the zenith or outside the atmosphere.

The atmospheric ozone in centimeters has been determined spectroscopically by Dobson and Harrison in England. These ozone determinations depend on the assumption that the form of the solar energy-curve remains constant in the ultra-violet, the apparatus being calibrated fundamentally at one epoch only, the first two weeks in June, 1925. It is probable that the increase in ultra-violet radiation has been interpreted as a decrease in ozone, and a recalibration by the fundamental method should show a return to normal ozone content.

## PARALLAXES OF NINE STARS IN THE PLEIADES.

By John H. Pitman.

The group of stars here discussed were photographed with the Sproul visual refractor through six epochs from January, 1922 to August, 1924. The center of the region covered by the photographs is approximately two minutes preceding and one degree north of Alcyone. Because of the distribution of the stars in the field, no occulting disc was used.

Stars not appearing in Trumpler's list of Pleiades stars were chosen

as comparison stars with one exception. In each case, four comparison stars, fairly symmetrically distributed with respect to the parallax star, were used. The average magnitude of the comparison stars was 10.9. From Trumpler's data, one star in the following list, T 109, is not a member of the cluster differing markedly in proper motion from the average of the group.

| Trumpler No. | Magnitude Potsdam | Relative Parallax | | Relative Proper Motion per 100 Days in R. A. | | No. of Plates |
|---|---|---|---|---|---|---|
| 98 | 10.98 | +0".045 | ±0".010 | +0".001 | ±0".003 | 19 |
| 108 | 10.75 | .041 | .006 | + .006 | .002 | 19 |
| 109 | 8.99 | .048 | .011 | + .010 | .003 | 19 |
| 113 | 11.16 | .043 | .006 | — .002 | .002 | 18 |
| 131 | 10.02 | .024 | .005 | + .003 | .001 | 20 |
| 180 | 9.38 | .012 | .011 | — .001 | .003 | 20 |
| 187 | 9.93 | .031 | .007 | + .004 | .002 | 19 |
| 221 | 9.72 | .001 | .009 | + .002 | .002 | 20 |
| 251 | 10.9 | .007 | .008 | — .001 | .002 | 21 |

## GRAVITATION, TIME, AND EINSTEIN.

By Charles Lane Poor.

The most spectacular claim of Einstein and his followers is that of the discovery of a "new" law of gravitation, the claim that there is something radically wrong with Newton's law of inverse squares. This claim is based solely upon a certain formula for planetary motion deduced by Einstein in 1915, and by the fact that this formula appears to explain a minute discordance in the motions of the planet Mercury.

This new law of Einstein appears to be so complicated that neither Einstein nor any of his followers has ever explained in simple, understandable language just what it really is and exactly how it differs from that of Newton. As a definite result of this new law, however, it is stated that all planets describe about the sun paths, which differ slightly from those indicated by the simple Newtonian law of inverse squares; and a definite mathematical formula is given for this difference in paths. But the way in which Einstein derived this formula for planetary motion is not given in any standard work on relativity; even in Einstein's original paper on "The Foundation of the General Theory of Relativity" one does not find a mathematical derivation of this basic formula.

Through a foot-note reference the original paper of Einstein was located; the paper, which contains his original and only known derivation of this formula for planetary motion. This paper was published in 1915 in Berlin,* and this present note is based upon the formulas and methods of that authentic and basic document of relativity.

In developing his formula for planetary motion, Einstein starts with

*Einstein: "Erklärung der Perihelbewegung des Merkur." *Sitzungsber. d. Preuss. Akad. d. Wiss.*, **47**, 831, 1915. The references to this paper are noted in the text by the number of the page on which the quotation is found.

a very general mathematical expression, which, subject to special values of the factors involved, may represent the motions of a body under any and all conditions. For one specific set of values this general formula will represent the motion of a body at an infinite distance from all other bodies; for another specific set the formula represents the motion of the body when acted upon by a single gravitational mass, such as the sun. The successive introduction of these various factors, or specific values of factors, into the general expression is called by Einstein "approximations." Thus when all the factors vanish and the material point, or body is removed from all outside influence or attraction, Einstein shows that the point would move uniformly and in a straight line. This Einstein calls the "zero'th approximation." When he introduces a single factor into his general formula, he calls the result the "first approximation"; when he introduces additional factors, he calls the new result his "second approximation."

For his "first approximation" Einstein introduces into his general formula a factor representing the Newtonian gravitational potential, a factor depending solely upon Newton's law of inverse squares. This factor assumes that the force at any point in the gravitational field is inversely proportional to the square of its distance from the central body. Einstein, himself, states this fact in unmistakable words when he says that this factor depends upon "the fundamental tensor alone" and that this fundamental tensor "plays the part of the gravitational potential." He writes the resultant equation for the component acceleration in the direction of the axis of $X$ as: (835)

$$d^2x/ds^2 = -\alpha/2 \cdot x/r^3 \qquad (1)$$

where "$\alpha$ is a constant determined by the mass of the sun." And there are two similar equations for the components in the direction of $X_2$ and $X_3$, or of $Y$ and $Z$, as usually written. If the axis of $X$ be taken as coincident with the radius-vector of the planet, then this equation would be written:

$$d^2r/ds^2 = -(\alpha/2)/r^2 \qquad (1:1)$$

and it is apparent that the law of force is the "inverse square law" of Newton. Thus the Einstein equation is identical with the ordinary Newtonian formula:—the so-called "first approximation" is simply classical mechanics; uniform constant time, measuring-rods of constant lengths, and Newton's law of inverse squares.

Now Einstein transforms this Newtonian equation and finds for the resultant typical equation, which represents the component acceleration in his "second approximation," (837)

$$d^2x/ds^2 = -\alpha/2 \cdot x/r^3 \cdot (1 + 3B^2/r^2) \qquad (2)$$

where $B$ is the constant of areas. And this equation differs from that of the"first approximation"solely by the presence of the factor $(1+3B^2/r^2)$ in the second member. It is the small term, $3B^2/r^2$, which, in the integrated form of the equation, becomes the so-called "perihelial" term

of the relativists and gives rise to the celebrated 43″ per century in the supposed relativity motion of Mercury. Any modification, whatsoever, of this small term would change the 43″, as calculated for Mercury's orbit, and would completely destroy the edifice of proof erected upon this particular value.

The first members of these two equations, (1) and (2), represent the component accelerations of the planet caused by the attraction of the sun, or by the gravitational field of the sun, as Einstein would express it. Acceleration is the rate of change of velocity with the time, and, in these equations, Einstein uses the letter $s$ to represent the "time-variable" (837), so that $ds$ represents an infinitesimally small interval of time. The second members of the equations show clearly that the accelerations, as given in the two equations, are different; that the acceleration represented by the second, or Einstein equation is the larger of the two. The "first" equation represents the component acceleration due to the inverse square law of Newton; the "second" equation represents that acceleration increased by the factor $(1 + 3\,B^2/r^2)$.

This difference in the two accelerations may be caused either by different laws of gravitation, or by different intervals of time for the measurement of the accelerations. If, in the two equations, the $ds$ represents the same interval, then it is perfectly clear that the equations represent different laws of gravitation. For, in this case, the Einstein equation states that the acceleration, due to the gravitational action of the sun, is greater than that indicated by the law of Newton. But, if the $ds$ represents different intervals in the two equations, then the increased acceleration of the "second" equation may be due to a proportionally larger time interval. For the acceleration at the surface of the earth, due to the earth's gravitational attraction, is some 32 feet per second; but, when measured in terms of minutes, this same acceleration is over 20 miles. Thus the whole question as to whether Einstein discovered a "new" law of gravitation depends absolutely upon the identity, or non-identity of the respective intervals *"ds"* in the two equations.

This question can be set at rest, once and for all time, by a simple quotation from the original paper in which Einstein first derived his "second" approximate equation and first set forth his claims as to the proof of his theories by the motion of Mercury. In this paper, in the section in which are introduced the necessary factors to change the "first" into the "second" approximation, is to be found the direct statement: (837)

"Let one finally choose $s\sqrt{1-2A}$ as the time-variable and call this latter again $s$, . . ."

Thus, according to Einstein's own printed statement the *"ds"* in the two formulas are not the same. This general fact of non-identity does not depend upon an interpretation of complicated mathematical formulas; it is supported by the above clear and unequivocal statement.

Einstein states in clear, unmistakable words that the respective intervals "*ds*" in the two equations are not identical; and with this admission of non-identity vanishes the whole edifice of the so-called proof of the relativity theory by the perihelial motion of Mercury.

In transforming the "first approximation," or Newtonian formula of planetary motion into the "second approximation," Einstein introduces other "time factors" in addition to the one above specifically mentioned. But the introduction of these additional factors can only be shown by the mathematical methods used:—such introduction is not clearly set forth in words. The entire transformation factor, as used by Einstein, is:

$$1 + 3\,B^2/r^2$$

and this factor represents the relation between the respective $(ds)^2$ of the two formulas; represents the ratio of the squares of the "time intervals." The increased acceleration of the "second approximation" is thus due to an increased time interval, and not to a different law of gravitation.

In interpreting his transformed formula as representing a new law of gravitation Einstein makes a fundamental error in logic. He clearly and admittedly derives this formula (2), or "second approximation" for the acceleration of a planet in its orbit from the "first approximation," or Newtonian formula. The Einstein formula is thus a transformed Newtonian formula, and it must, therefore, involve and depend upon the fundamental factors of the Newtonian equation. The introduction of additional factors representing new methods of measurement in time and in space cannot change the fundamental factors of the original equation. No mathematical manipulation can alter the basic principle of logic:—a conclusion must involve and depend upon the premises from which it was derived. Einstein puts the Newtonian law of inverse squares into his basic formulas, and his final result, if correctly and logically derived, must inevitably involve and depend upon this underlying principle.

Had Einstein been familiar with the methods and formulas of celestial mechanics, he might not have made this error in logic, for he should then have realized that his transformation was not complete. In the ordinary formulas of physics and dynamics there are three fundamental, arbitrary, and independent units of measurement:—those of length, time, and mass. In celestial dynamics, however, there are but two such independent units:—those of length and of time. In the formulas of celestial dynamics the unit measure of mass is a derived unit, is a function of the units of length and of time, and will, therefore, vary as one adopts different units for measurements in space and in time. Einstein applied the methods of the mathematician and of laboratory physics to celestial mechanics, and kept his mass unit ($\alpha$) an absolute constant instead of changing it to conform to his new unit of theoretical relativity time. Thus the equation of his "second ap-

proximation" is not homogeneous in units:—the constant $a$ being expressed in terms of the uniform time of astronomy and the "time-variable" ($ds$) in terms of relativity units.

This non-homogeneity as to the units employed in the various terms of the Einstein equation may be corrected by noting that, as the expression for mass in celestial dynamics varies with the square of the time unit employed, the value of the constant becomes when expressed in relativity units:

$$a_r = a(1 + 3B^2/r^2).$$

With this relativity value for the "constant determined by the mass of the sun" Einstein's equation (2) becomes:

$$d^2x/ds^2 = -a_r/2 \cdot x/r^3. \qquad (3)$$

The equation is now homogeneous as to units of time, and it is of identically the same form as that of Newton. Thus a complete transformation in time units leaves the form of the equation unchanged, and the geometrical solution is identically the same as for that of Newton:—a fixed ellipse.

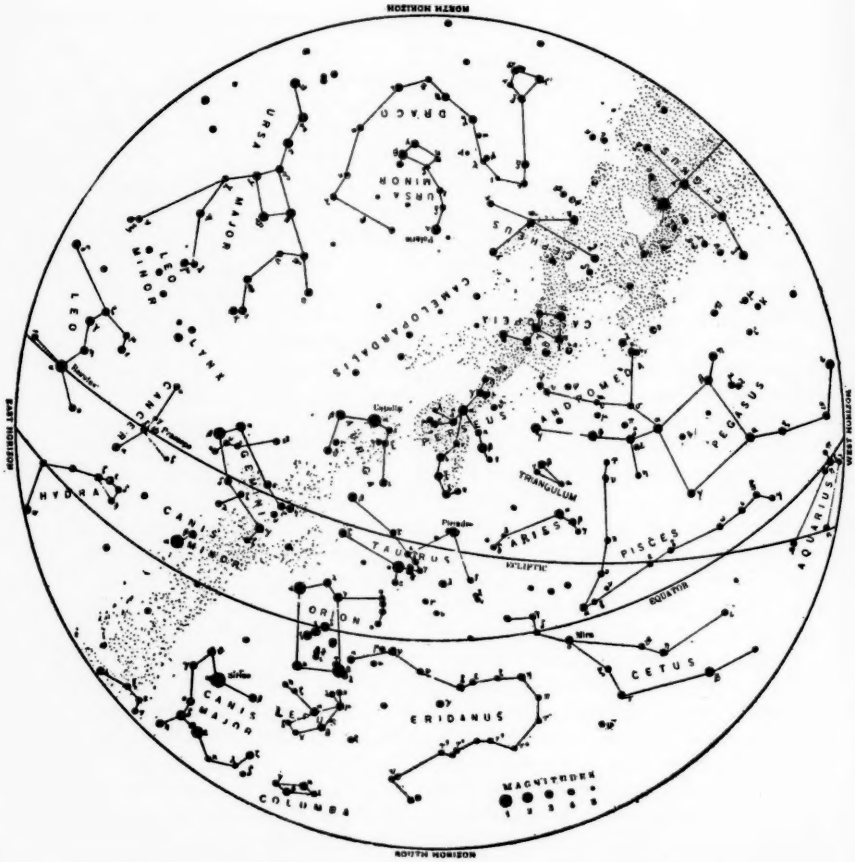
And thus the "perihelial term" of Einstein is merely a factor of transformation from one system of time units to another, analogous to the factors which change feet into meters, or dollars into francs. The unit of time used by Einstein in his form of the planetary equation is greater than a unit of ordinary astronomical time, and in a definite number of such relativity days, therefore, a planet will travel farther than it would in the same number of astronomical days. In one hundred years of Einstein's theoretical relativity time Mercury will travel farther than in a century of astronomical time: in the planetary formula this appears as 43″, and it is this 43″ that Einstein erroneously interprets as a "perihelial motion" of the planet's orbit.

A few months after this paper of Einstein appeared, Schwarzschild recast it in terms of the so-called "line element" and the more intricate methods of the present day relativists. And the writers on relativity now all practically adopt this Schwarzschild derivation, in which the transformation in time units is hidden away in a labyrinth of mathematical processes never before applied to physical and astronomical investigations. Thus Einstein's original paper is but little known, and his method of deriving the perihelial term is never mentioned. In the celebrated paper "The Foundation of the General Theory of Relativity" Einstein omits the derivation of this term and merely asserts that, under his theories, the orbital ellipse of a planet undergoes a slow rotation, but he furnishes no mathematical formulas, or derivations to sustain this assertion. The original paper on the perihelial motion is not in the collection of memoirs on "The Principle of Relativity," as reprinted from Lorentz, Einstein, Minkowski, and Weyl. Nor does this collection of papers contain any mathematical derivation of this basic formula of planetary motion, upon which are founded the relativists'

claims of a "new" law of gravitation and of the confirmation of their theories by the motions of Mercury.

Thus the original, but now unquoted and forgotten paper of Einstein shows, directly and without the possibility of doubt, that his formula of planetary motion is based upon and involves the Newtonian law of inverse squares; shows that he derived his formula from that of Newton by a direct transformation of time units. The Newtonian law has not been "abolished": there is no Einsteinian law of gravitation.

*(To be continued.)*




THE CONSTELLATIONS AT 9:00 P. M. JANUARY 1.

## PLANET NOTES FOR JANUARY.

By CLIFFORD E. SMITH.

The *Sun*, during January, will be moving northeast in Sagittarius and Capricornus. Early in the month it crosses a field rich in bright stars in Sagittarius. Its position on January 3 will be R. A. $18^h\ 50^m\ 30^s$, Decl. $-22°\ 56'\ 27''$, which is about $3^\circ.5$ north of $\sigma$ Sagittarii. The position of the sun at the end of the month will be R. A. $20^h\ 50^m\ 15^s$, Decl. $-17°\ 43'\ 2''$.

The phases of the *Moon* will occur as follows:

| | | | | |
|---|---|---|---|---|
| New Moon | Jan. | 3 at | 2 P. M. | C.S.T. |
| First Quarter | | 10 " | 9 A. M. | " |
| Full Moon | | 17 " | 4 P. M. | " |
| Last Quarter | | 25 " | 8 P. M. | " |

The moon will be at perigee (nearest the earth) on January 7, and at apogee (farthest from the earth) on January 23.

*Mercury* will be near the sun, approaching it from the west. On January 1 it will rise about an hour before the sun, but at the end of the month it will be too close to the sun to be seen. Mercury will pass through aphelion on January 11, and it will be at superior conjunction on January 28.

*Venus* will be moving away from the sun on the east, but during this month it will be too close for observation. At the end of the month it will set about an hour after the sun. Venus will pass through aphelion on January 5.

*Mars* will be in a position very favorable for observation. It will cross the meridian about two hours after sunset on January 1. Its apparent motion is roughly toward the Pleiades, and at the end of the month it will be in Aries only about 10° from them.

*Jupiter* will be in Capricornus and on January 1 will set about three hours after the sun.

*Saturn* will be visible just before sunrise during January. At the end of the month it will precede the sun about four and a half hours.

*Uranus* will remain an object for evening observation in Pisces. On January 1 it will be on the meridian about 5:00 P. M.

*Neptune* will be a morning object. It is very near Regulus, less than a degree away. It will rise at the middle of the month about 8:00 P. M.

### Occultations Visible at Washington.

[From the *American Ephemeris.*]

| Date 1927 | | Star's Name | Magnitude | IMMERSION. Washington C.T. | IMMERSION. Angle from N | EMERSION. Washington C.T. | EMERSION. Angle from N | Duration |
|---|---|---|---|---|---|---|---|---|
| | | | | h m | ° | h m | ° | h m |
| Jan. | 1 | 123 B. Scorpii | 6.5 | 5 0 | 142 | 5 53 | 261 | 0 53 |
| | 6 | 29 Aqr. (mean) | 6.5 | 16 17 | 69 | 17 29 | 238 | 1 12 |
| | 8 | 30 Piscium | 4.7 | 21 4 | 110 | 21 44 | 195 | 0 40 |
| | 11 | 85 Ceti | 6.3 | 22 57 | 97 | 23 56 | 221 | 0 59 |
| | 12 | 30 B. Tauri | 6.4 | 23 59 | 90 | 1 3 | 240 | 1 4 |
| | 15 | $\eta$ Gemin (var.) | 3.2 | 17 32 | 71 | 18 36 | 263 | 1 4 |
| | 17 | 58 Geminorum | 6.0 | 0 45 | 58 | 1 48 | 320 | 1 3 |
| | 17 | $\mu$ Cancri | 5.5 | 18 25 | 127 | 19 14 | 232 | 0 49 |
| | 23 | *c* Virginis | 5.1 | 1 19 | 75 | 2 16 | 350 | 0 57 |
| | 28 | Saturn | 0.7 | 7 4 | 122 | 8 30 | 284 | 1 27 |
| | 30 | 1 Sagittarii | 5.2 | 5 24 | 119 | 6 30 | 268 | 1 6 |

## COMET NOTES.

By G. VAN BIESBROECK.

This month the number of comets announced since the beginning of the year has increased from five to seven, two more objects having been found on the same day, November 5.

COMET 1926 *f* (COMAS SOLÁ). The first comet discovered on November 5 was found at Barcelona (Spain) by J. Comas Solá by means of the 6-inch photographic telescope which he uses in his work on asteroids. The magnitude was given as 12. The comet, situated in the constellation of Cetus, is moving slowly northwestward, as can be seen from the following first positions:

| U. T. | h m s | ° ′ ″ | Observer | Place |
|---|---|---|---|---|
| 1926 Nov. 5.0000 | 2 56 36 | +6 31 | Comas Solá | Barcelona |
| 7.0260 | 54 41.7 | 6 38 33 | Krumpholz | Vienna |
| 8.1040 | 53 37 | 6 42 2 | Green | Amherst |
| 10.0814 | 51 39.97 | 6 49 1.8 | Van Biesbroeck | Williams Bay |
| 10.1394 | 51 35.5 | 6 49 16 | Merton | Greenwich |
| 11.2033 | 50 31.58 | 6 53 15.5 | Van Biesbroeck | Williams Bay |
| 12.2105 | 49 45.87 | 7 1 52.9 | Taylor | Ann Arbor |
| 21.1981 | 40 29.29 | 7 40 8.0 | Van Biesbroeck | Williams Bay |
| 22.0183 | 39 41.61 | 7 44 45.2 | Van Biesbroeck | Williams Bay |

On November 10 I recorded it with the 40-inch telescope as a nebulosity about 45″ in diameter with a well-defined nucleus and a short tail extending over 65″ in position-angle 280°. It was then still near opposition so that the tail was seen greatly foreshortened. Two parabolic orbits have come to hand so far:

| | Mr. Brigham and Miss Prescott<br>Berkeley, Calif. | M. Ebell<br>Kiel, Germany |
|---|---|---|
| Time of perihelion passage | 1927 April 21.33 | 1927 May 14.33 |
| Perihelion minus node | 58° 36′ | 62° 48′ |
| Longitude of ascending node | 59 10 | 57 15 |
| Inclination | 21 25 | 24 57 |
| Perihelion distance | 1.676 | 1.754 |

I have computed the following ephemeris from the Berkeley elements:

| U. T. | α<br>h m | δ<br>° ′ | Log *r* | Log Δ | Mag. |
|---|---|---|---|---|---|
| 1926 Nov. 24.0 | 2 37.3 | + 7 54 | 0.402 | 0.200 | 12.0 |
| 28.0 | 33.3 | 8 19 | | | |
| Dec. 2.0 | 29.5 | 8 46 | 0.390 | 0.193 | 11.9 |
| 6.0 | 26.0 | 9 15 | | | |
| 10.0 | 22.7 | 9 47 | 0.377 | 0.190 | 11.8 |
| 14.0 | 19.9 | 10 21 | | | |
| 18.0 | 17.5 | 10 58 | 0.365 | 0.191 | 11.8 |
| 22.0 | 15.6 | 11 38 | | | |
| 26.0 | 14.1 | 12 20 | 0.352 | 0.196 | 11.7 |
| 30.0 | 13.3 | 13 4 | | | |
| 1927 Jan. 3.0 | 2 13.0 | +13 50 | 0.340 | 0.202 | 11.7 |

The correction on November 22 was +22ˢ, +2′.

Although these elements, deduced from a very short interval of time, are still uncertain they sufficiently define the future course of this object, which will come to its closest approach to the sun some six months from now. It will be well placed in the evening sky in the first months of 1927 and move slowly through the constellations of Aries and Perseus. But the distance to the earth is not de-

creasing appreciably and the perihelion distance is rather large so that no great physical activity is to be expected. The brightness will presumably not increase by more than one magnitude. The early discovery will make it possible to follow this comet over many months and thus to determine its orbit with great accuracy.

COMET 1926 *g* (NEUJMIN) = PERIODIC COMET NEUJMIN 1916 II. On the same night on which Comas Solá's comet was first photographed, G. Neujmin recorded photographically another comet, designated as 1926 *g*. As far as known 1926 *f* is a new object; 1926 *g* on the contrary is the return of an expected periodic comet which was first found by G. Neujmin himself in 1916 at Simeis, the Crimean station of the Pulkova Observatory in Russia. At that time it appeared as an object of magnitude 10.5, and was followed from February 24 to June 5. It soon proved to have an elliptic orbit. Neujmin himself computed the orbit and found a period as short as 5.4 years. At the following return the conditions of observation were not favorable. Yet Neujmin succeeded, 1920 November 16, in photographing a moving object, not brighter than 15-16$^{M}$, which he suspected to be the comet. The identity being somewhat doubtful, for the present return two orbits were derived by the Computing section of the British Astronomical Association (*Journal Brit. Astr. Assoc.* **36**, 342, 1926). The first was obtained by applying the perturbations to the orbit representing the 1916 apparition only; for the second the elements were adjusted so as to represent the 1920 observation and were further brought up to the present epoch by computing perturbations due to the major planets. The comet was found in a position intermediate between the two alternatives and this gives 1927 January 16 for the date of perihelion passage. The telegraphic position sent by Neujmin is:

1926 Nov. 5.0680 $10^{h}\,10^{m}\,56^{s}$ $+18°\,29'$ $14^{M}.5$.

I observed the comet photographically as follows:

1926 Nov. 11.44865 $10^{h}\,29^{m}\,39^{s}.67$ $+16°\,16'\,15''.8$ $15^{M}.0$.

Mr. G. Neujmin is to be congratulated for his success in keeping track of this comet, which now will be added to the list of well established members of the solar system. It will now be possible to determine whether former apparitions of the comet have not been recorded. It has been noticed that the plane of the orbit coincides very nearly with that of Encke's periodic comet and that the two lines of apsides are in the same direction but the orbit of Neujmin's comet is larger and less eccentric.

I have interpolated the following ephemeris from those given by the British computers:

| U. T. 1926 | $\alpha$ h m | $\delta$ ° ′ | Mag. |
|---|---|---|---|
| Nov. 24.0 | 11 6.6 | +11 22 | 14 |
| Dec. 2.0 | 11 30.1 | 7 54 | |
| 10.0 | 11 53.6 | 4 13 | |
| 18.0 | 12 17.0 | + 0 22 | |
| 26.0 | 12 40.2 | — 3 39 | 13 |

The other comets now observable have again been measured at the Yerkes Observatory: Comets 1925 *b* (Reid), 1926 *c* (Kopff) and 1926 *d* (Finlay) are, however, near the limit of our instruments.

Comet 1926 *e* (Giacobini-Zinner) was measured several times and on November 6 it had brightened up to 13$^{M}$. In the 40-inch refractor it showed a sharp nucleus surrounded by a nebulosity about 20″ in diameter extending into the first quadrant into a dissymmetrical tail; the main part was visible up to 80″ from the

nucleus in direction 60°, while in 40° there was a second fainter streamer only 60″ in length. The ephemeris given in the November issue (p. 599) will enable observers to follow the comet.

Comet 1925 *a* (Shajn-Comas Solá), as anticipated last month, has been again recorded here:

| U. T. | α h m s | δ ° ′ ″ | Instrument |
|---|---|---|---|
| Oct. 15.4222 | 7 13 14.48 | —11 21 15.3 | 24-inch reflector (photo.) |
| Nov. 10.3225 | 6 51 10.14 | —14 3 46.6 | 40-inch refractor (vis.) |
| 11.3266 | 6 50 12.85 | —14 9 16.5 | 40-inch refractor |

The brightness corresponds to 15M. It appeared as a round nebulosity 20″ in diameter without appreciable nucleus. The period of visibility is thus extended to 600 days and very likely several months may yet be added to this duration until the object becomes too faint. The following ephemeris, computed by S. Kanda (*Tokyo Circ.* 16), represents the measures quite closely:

| U. T. 1926 | α h m s | δ ° ′ | Mag. |
|---|---|---|---|
| Nov. 17.0 | 6 44 24 | —14 38.4 | 14.6 |
| 25.0 | 35 36 | 15 14.6 | |
| Dec. 3.0 | 26 5 | 15 42.7 | |
| 11.0 | 16 3 | 16 1.1 | |
| 19.0 | 6 5 46 | 16 9.0 | |
| 27.0 | 5 55 33 | —16 5.9 | 14.6 |

Opposition December 23.

Yerkes Observatory, Williams Bay, Wisconsin.
November 22, 1926.

## METEOR NOTES.

**By CHARLES P. OLIVIER.**

During the two months from early in November to early in January of every year the earth's orbit is intersected by those of four of the most important of the meteor streams. These are in order: the Leonids, November 13-17; the Bielids, probably about November 20 but exact date most uncertain; the Geminids, December 7-13; the Quadrantids, January 1-3. Before this note appears in print the first two showers will be over, but observations on each are most desirable; on the Leonids to see whether there are any indications of increasing numbers as we near 1932, on the Bielids to see whether we meet any of them whatever. It may be remembered that not since 1899 have any appreciable number of Bielids been seen.

As for the Geminids, we have here one of the finest regular showers of the year. But due probably to cold weather it has been much less observed than one might expect. Towards the maximum, which occurs within a day of December 12, hourly numbers up to 50 are sometimes observed. The radiant rises in the early hours of the night so one is not forced to wait until after midnight to see these meteors. They are characterized by short paths and most of them are not very bright. Yet due to their slow relative velocity, for they obviously overtake the earth, they are not very swift and their numbers make it possible to determine a good radiant in a reasonable period of observation. An important paper dealing with the shift of this radiant, night by night, has recently been published by A. King of England in *Monthly Notices of the R. A. S.* Observers are urged to

make efforts to follow this rich stream this December, as the moon will scarcely interfere and more data are much needed.

The Quadrantids of January are best seen after midnight, their radiant being rather near Ursa Major. Even the exact position of the radiant is not well known, and almost nothing therefore as to its daily motion. These meteors, while not so numerous as the Geminids, usually give longer apparent paths, and are more individually interesting. From what has been said observations are seen to be urgently needed. For neither of these streams have attempts to connect their orbits with those of comets been successful. Here again lies the possibility of a real discovery, though it may well be that the accompanying comets have disintegrated, assuming indeed that such ever existed which is far from a certainty.

Observers should make the most of these two chances, since not until the April Lyrids will the earth meet another really rich shower. All of December seems to be a period when meteors are quite frequent, so nobody need confine his observations to the dates mentioned above.

## COMMUNICATION.

**American Astronomical Society Announcement.** — The thirty-seventh meeting of the Society will be held December 28 to 30, 1926, at the University of Pennsylvania, Philadelphia, in affiliation with the American Association for the Advancement of Science. The usual reduced railroad rates on the certificate plan will be available.

The Hotel Walton, Broad and Locust streets, has been designated as headquarters for the meeting. The following rates have been quoted:

| | |
|---|---|
| Single room with running water | $3.00-$4.00 per day |
| Single room with bath | $3.50-$4.00 " " |
| Double room with running water | $5.00-$6 00 " " |
| Double room with bath | $6.00-$8.00 " " |

For members desiring rooms at more moderate rates, accommodations may be secured at the Young Men's Christian Association, near Broad and Arch streets. Members are urged to make their hotel reservations well in advance.

The sessions for papers will be held at the University of Pennsylvania, in rooms to be assigned later. It is proposed to have Tuesday, Dec. 28, open for meetings with other societies, while sessions for papers of the Astronomical Society will be held in the morning and afternoon of Wednesday and Thursday. One session will be in charge of Section D—Astronomy.

COMMUNICATIONS.

Titles of papers which are received by the secretary at Madison by December 12 will be placed on the printed program, subject to the approval of the Council. When two or more papers are offered by the same member, one only of these will be assigned a place on the regular program, while the others will be placed on a supplementary program to be called for if time permits.

As usual, authors are reminded that informal and extemporaneous presentation is preferred to the reading of a detailed manuscript such as would appear in print.

JOEL STEBBINS, *Secretary.*

Washburn Observatory, Madison, Wisconsin.

# VARIABLE STARS.

## Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract $5^h$; Central Standard time $6^h$. etc.

| Star | R.A. 1900 | | Decl. 1900 | | Magnitude | Approx. Period | | Greenwich civil times of Minima in 1927 January | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h | m | ° | ′ | | d | h | d | h | d | h | d | h | d | h |
| SY Androm. | 0 | 08.0 | +43 | 09 | 9.5—13.0 | 34 | 21.8 | 2 | 9 | | | | | | |
| RT Sculptor. | | 31.5 | —26 | 13 | 9.6—10.5 | 0 | 12.3 | 5 | 15 | 13 | 7 | 20 | 23 | 28 | 16 |
| U Cephei | 0 | 53.4 | +81 | 20 | 7.0— 9.0 | 2 | 11.8 | 6 | 9 | 13 | 20 | 21 | 7 | 28 | 18 |
| Z Persei | 2 | 33.7 | +41 | 46 | 9.4—12 | 3 | 01.4 | 5 | 1 | 11 | 4 | 23 | 9 | 29 | 12 |
| TW Cassiop. | | 37.6 | +65 | 19 | 8.2— 9.0 | 1 | 10.3 | 3 | 17 | 12 | 7 | 20 | 20 | 29 | 10 |
| RY Persei | | 39.0 | +47 | 43 | 8.0—10.3 | 6 | 20.7 | 5 | 12 | 12 | 9 | 19 | 6 | 26 | 3 |
| RZ Cassiop. | | 39.9 | +69 | 13 | 6.9— 8.1 | 1 | 04.7 | 1 | 10 | 8 | 14 | 22 | 22 | 30 | 2 |
| TX Cassiop. | | 44.4 | +62 | 22 | 9.4—10.1 | 2 | 22.2 | 5 | 14 | 14 | 9 | 23 | 4 | 31 | 22 |
| ST Persei | | 53.7 | +38 | 47 | 8.5—10.5 | 2 | 15.6 | 2 | 22 | 10 | 21 | 18 | 20 | 26 | 18 |
| RX Cassiop. | 2 | 58.8 | +67 | 11 | 8.6— 9.1 | 32 | 07.6 | | | | | | | 30 | 20 |
| Algol | 3 | 01.7 | +40 | 34 | 2.3— 3.5 | 2 | 20.8 | 7 | 8 | 15 | 23 | 24 | 13 | | |
| RT Persei | | 16.7 | +46 | 12 | 9.5—11.5 | 0 | 20.4 | 7 | 13 | 14 | 8 | 21 | 3 | 27 | 22 |
| λ Tauri | | 55.1 | +12 | 12 | 3.3— 4.2 | 3 | 22.9 | 2 | 4 | 10 | 2 | 18 | 0 | 25 | 21 |
| RW Tauri | 3 | 57.8 | +27 | 51 | 7.1— [11 | 2 | 18.5 | 4 | 11 | 12 | 17 | 21 | 1 | 29 | 7 |
| RV Persei | 4 | 04.2 | +33 | 59 | 9.5—11.0 | 1 | 23.4 | 8 | 23 | 16 | 20 | 24 | 18 | | |
| RW Persei | | 13.3 | +42 | 04 | 8.8—11.0 | 13 | 04.8 | 8 | 0 | | | 21 | 5 | | |
| SZ Tauri | | 31.4 | +18 | 20 | 7.2— 7.7 | 3 | 03.6 | 5 | 1 | 11 | 8 | 23 | 22 | 30 | 5 |
| RS Cephei | 4 | 48.6 | +80 | 06 | 9.5—12.0 | 12 | 10.1 | | | 10 | 7 | 22 | 17 | | |
| TT Aurigae | 5 | 02.8 | +39 | 27 | 7.8— 8.7 | 0 | 16.0 | 5 | 9 | 12 | 1 | 18 | 17 | 25 | 9 |
| RY Aurigae | | 11.5 | +38 | 13 | 10.7—11.7 | 2 | 17.5 | 5 | 15 | 13 | 19 | 22 | 0 | 30 | 4 |
| RZ Aurigae | | 42.9 | +31 | 40 | 10.6—13.3 | 3 | 00.3 | 8 | 23 | 15 | 0 | 21 | 0 | 27 | 1 |
| SV Tauri | | 45.8 | +28 | 05 | 9.4—11.0 | 2 | 04.0 | 8 | 20 | 17 | 12 | 26 | 4 | | |
| Z Orionis | | 50.2 | +13 | 40 | 9.7—10.7 | 5 | 04.9 | 8 | 6 | 18 | 15 | 29 | 1 | | |
| SV Gemin. | | 54.6 | +24 | 28 | 9.8— [11 | 4 | 00.2 | 7 | 8 | 15 | 9 | 23 | 9 | 31 | 9 |
| RW Gemin. | 5 | 55.4 | +23 | 08 | 9.5—11.0 | 2 | 20.8 | 1 | 9 | 12 | 20 | 18 | 13 | 30 | 1 |
| U Columbæ | 6 | 11.2 | —33 | 03 | 9.2—10.0 | 2 | 19.2 | 4 | 22 | 10 | 12 | 21 | 17 | 27 | 8 |
| SX Gemin. | | 22.0 | +20 | 37 | 10.8—11.5 | 1 | 08.8 | 3 | 22 | 12 | 3 | 20 | 8 | 28 | 13 |
| RW Monoc. | | 29.3 | + 8 | 54 | 9.0—10.8 | 1 | 21.7 | 5 | 5 | 12 | 20 | 20 | 11 | 28 | 2 |
| RX Gemin. | | 43.6 | +33 | 21 | 8.8— 9.6 | 12 | 05.0 | | | 11 | 20 | 24 | 1 | | |
| RU Monoc. | 6 | 49.4 | — 7 | 28 | 9.8—10.5 | 0 | 21.5 | 4 | 13 | 11 | 17 | 18 | 21 | 26 | 1 |
| R Can. Maj. | 7 | 14.9 | —16 | 12 | 5.8— 6.4 | 1 | 03.3 | 3 | 15 | 10 | 11 | 24 | 2 | 30 | 22 |
| RY Gemin. | | 21.7 | +15 | 52 | 8.9— [10 | 9 | 07.2 | 7 | 21 | 17 | 5 | 26 | 12 | | |
| Y Camelop. | | 27.6 | +76 | 17 | 9.5—12 | 3 | 07.3 | 7 | 5 | 13 | 19 | 20 | 10 | 27 | 1 |
| TX Gemin. | | 30.3 | +17 | 08 | 10.0—11.9 | 2 | 19.2 | 8 | 1 | 16 | 11 | 24 | 20 | | |
| RR Puppis | | 43.5 | —41 | 08 | 9.4—10.7 | 6 | 10.3 | 4 | 17 | 11 | 4 | 24 | 1 | 31 | 11 |
| V Puppis | 7 | 55.4 | —48 | 58 | 4.1— 4.8 | 1 | 10.9 | 2 | 1 | 9 | 8 | 23 | 21 | 31 | 4 |
| X Carinæ | 8 | 29.1 | —58 | 53 | 7.9— 8.7 | 0 | 13.0 | 6 | 3 | 14 | 6 | 22 | 9 | 30 | 12 |
| S Cancri | 8 | 38.2 | +19 | 24 | 8.2—10 | 9 | 11.6 | 2 | 7 | 11 | 19 | 21 | 6 | 30 | 18 |
| RX Hydræ | 9 | 00.8 | — 7 | 52 | 9.1—10.5 | 2 | 06.8 | 11 | 5 | 18 | 2 | 24 | 22 | 31 | 18 |
| S Velorum | | 29.4 | —44 | 46 | 7.8— 9.3 | 5 | 22.4 | 8 | 5 | 14 | 3 | 26 | 0 | 31 | 22 |
| Y Leonis | 9 | 31.1 | +26 | 41 | 9.3—11.2 | 1 | 16.5 | 6 | 0 | 12 | 19 | 19 | 11 | 26 | 5 |
| RR Velorum | 10 | 17.8 | —41 | 36 | 10.0—10.9 | 1 | 20.5 | 9 | 4 | 16 | 14 | 24 | 1 | 31 | 10 |
| SS Carinæ | 10 | 54.2 | —61 | 23 | 12.2—12.8 | 3 | 07.2 | 7 | 12 | 14 | 3 | 20 | 17 | 27 | 5 |
| ST Urs. Maj. | 11 | 22.4 | +45 | 44 | 6.7— 7.2 | 8 | 19.2 | 10 | 3 | 18 | 22 | 27 | 17 | | |
| RW Urs. Maj. | | 35.4 | +52 | 34 | 10.3—11.4 | 7 | 07.9 | 6 | 7 | 13 | 15 | 20 | 22 | 28 | 6 |
| Z Draconis | 11 | 39.8 | +72 | 49 | 9.9—13.6 | 1 | 08.6 | 10 | 4 | 16 | 23 | 23 | 18 | 30 | 13 |
| RZ Centauri | 12 | 55.6 | —64 | 05 | 8.5— 8.9 | 1 | 21.0 | 3 | 5 | 10 | 17 | 18 | 5 | 25 | 17 |
| RS Can. Ven. | 13 | 06.3 | +36 | 28 | 7.5—12.5 | 4 | 19.1 | 3 | 21 | 13 | 12 | 23 | 3 | | |
| SS Centauri | | 07.2 | —63 | 37 | 8.8—10.4 | 2 | 11.5 | 4 | 13 | 11 | 23 | 19 | 9 | 26 | 19 |

**Minima of Variable Stars of Short Period—Continued.**

| Star | R.A. 1900 | Decl. 1900 | Magnitude | Approx. Period | Greenwich civil times of Minima in 1927 January | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | h m | ° ′ | | d h | d h | d h | d h | d h | d h | |
| SX Hydræ | 13 39.0 | −26 23 | 8.6—12.7 | 2 21.5 | 4 14 | 13 7 | 21 23 | 30 16 | | |
| δ Libræ | 14 55.6 | — 8 07 | 4.8— 6.2 | 2 07.9 | 3 15 | 10 14 | 24 13 | 31 13 | | |
| U Coronæ | 15 14.1 | +32 01 | 7.6— 8.7 | 3 10.9 | 7 20 | 14 17 | 21 15 | 28 12 | | |
| TW Draconis | 15 32.4 | +64 14 | 7.3— 8.9 | 2 19.4 | 6 16 | 15 2 | 23 12 | 31 22 | | |
| SS Libræ | 15 43.4 | −15 14 | 9.3—11.5 | 0 18.4 | 1 2 | 8 6 | 22 16 | 29 20 | | |
| SW Ophiuchi | 16 11.1 | — 6 44 | 9.2—10.0 | 2 10.7 | 4 10 | 11 17 | 19 2 | 26 10 | | |
| SX Ophiuchi | 12.6 | — 6 25 | 10.5—11.2 | 2 01.5 | 1 17 | 9 23 | 18 6 | 26 12 | | |
| R Aræ | 31.1 | −56 48 | 6.8— 7.9 | 4 10.2 | 3 21 | 12 18 | 21 15 | 30 11 | | |
| TT Herculis | 16 49.9 | +17 00 | 8.9— 9.3 | 20 18.1 | | 18 1 | | | | |
| TU Herculis | 17 09.8 | +30 50 | 9.5—12 | 2 06.4 | 1 20 | 8 15 | 22 5 | 29 1 | | |
| U Ophiuchi | 11.5 | + 1 19 | 6.0— 6.7 | 1 16.2 | 8 6 | 16 15 | 25 1 | | | |
| u Herculis | 13.6 | +33 12 | 4.6— 5.4 | 2 01.2 | 5 14 | 11 18 | 24 1 | 30 5 | | |
| TX Herculis | 15.4 | +42 00 | 8.3— 9.0 | 2 01.4 | 4 16 | 10 20 | 23 5 | 29 9 | | |
| RV Ophiuchi | 29.8 | + 7 19 | 9. —12 | 3 16.5 | 1 19 | 9 4 | 23 23 | 31 7 | | |
| SZ Herculis | 36.0 | +33 01 | 9.5—10.3 | 0 19.6 | 5 2 | 13 6 | 21 11 | 29 15 | | |
| TX Scorpii | 48.6 | −34 13 | 7.5— 8.2 | 0 22.6 | 7 11 | 15 0 | 22 12 | 30 2 | | |
| UX Herculis | 49.7 | +16 57 | 8.8—10.5 | 1 13.2 | 6 12 | 14 6 | 22 0 | 29 17 | | |
| Z Herculis | 53.6 | +15 09 | 7.1— 7.9 | 3 23.8 | 4 13 | 12 13 | 20 12 | 28 12 | | |
| WX Sagittarii | 53.6 | −17 24 | 9.2—10.8 | 2 03.1 | 6 11 | 15 0 | 23 12 | | | |
| WY Sagittarii | 17 54.9 | −23 01 | 9.5—10.6 | 4 16.0 | 5 1 | 14 9 | 19 1 | 28 10 | | |
| SX Draconis | 18 03.0 | +58 23 | 9.3—10.5 | 5 04.1 | 6 2 | 16 10 | 21 14 | 31 22 | | |
| RS Sagittarii | 11.0 | −34 08 | 5.9— 6.3 | 2 10.0 | 3 12 | 10 18 | 18 0 | 25 5 | | |
| V Serpentis | 11.1 | −15 34 | 9.5—11.1 | 3 10.9 | 6 16 | 13 14 | 20 12 | 27 10 | | |
| RZ Scuti | 21.1 | — 9 15 | 7.4— 8.3 | 15 03.2 | 9 17 | | 24 20 | | | |
| RZ Draconis | 21.8 | +58 50 | 9.5—10.2 | 0 13.2 | 7 15 | 14 19 | 21 23 | 29 3 | | |
| RX Herculis | 26.0 | +12 32 | 7.0— 7.6 | 0 21.3 | 7 2 | 14 5 | 21 8 | 28 10 | | |
| SX Sagittarii | 39.7 | −30 36 | 8.7— 9.8 | 2 01.8 | 4 20 | 13 3 | 21 11 | 29 18 | | |
| RR Draconis | 40.8 | +62 34 | 9.3—13 | 2 19.9 | 2 12 | 10 23 | 19 11 | 27 23 | | |
| RS Scuti | 43.7 | −10 21 | 9.3—10.3 | 0 15.9 | 4 4 | 11 1 | 24 8 | 30 23 | | |
| β Lyræ | 46.4 | +33 15 | 3.4— 4.1 | 12 21.8 | 3 17 | 16 15 | 28 13 | | | |
| U Scuti | 18 48.9 | −12 44 | 9.1— 9.6 | 0 22.9 | 1 22 | 9 13 | 17 5 | 24 20 | | |
| RX Draconis | 19 01.1 | +58 35 | 9.3—10.2 | 1 21.4 | 1 12 | 9 2 | 24 5 | 31 19 | | |
| RV Lyræ | 12.5 | +32 15 | 11. —12.8 | 3 14.4 | 5 15 | 12 20 | 20 1 | 27 6 | | |
| RS Vulpec. | 13.4 | +22 16 | 6.9— 8.0 | 4 11.4 | 6 18 | 15 17 | 24 16 | | | |
| U Sagittæ | 14.4 | +19 26 | 6.5— 9.0 | 3 09.1 | 1 15 | 8 9 | 21 22 | 28 16 | | |
| Z Vulpec. | 17.5 | +25 23 | 7.3— 8.5 | 2 10.9 | 1 3 | 8 12 | 23 5 | 30 14 | | |
| TT Lyræ | 24.3 | +41 30 | 9.4—11.6 | 5 05.8 | 1 21 | 12 9 | 17 15 | 28 2 | | |
| UZ Draconis | 26.1 | +68 44 | 9.0— 9.8 | 1 15.1 | 3 3 | 9 15 | 22 16 | 29 5 | | |
| SY Cygni | 19 42.7 | +32 28 | 10. —12 | 6 00.2 | 3 15 | 9 15 | 21 15 | 27 15 | | |
| WW Cygni | 20 00.6 | +41 18 | 9.3—13.4 | 3 07.6 | 6 21 | 13 13 | 20 4 | 26 19 | | |
| SW Cygni | 03.8 | +46 01 | 9. —11.7 | 4 13.8 | 3 8 | 12 12 | 21 13 | 30 19 | | |
| VW Cygni | 11.4 | +34 12 | 9.8—11.8 | 8 10.3 | 8 1 | 16 11 | 24 21 | | | |
| RW Capric. | 12.2 | −17 59 | 8.8—10.6 | 3 09.4 | 7 5 | 14 0 | 20 19 | 26 13 | | |
| UW Cygni | 19.6 | +42 55 | 10.5—13 | 3 10.8 | 6 10 | 13 7 | 20 5 | 27 2 | | |
| V Vulpec. | 32.3 | +26 15 | 8.2— 9.8 | 37 19.0 | | | | | | |
| W Delphini | 33.1 | +17 56 | 9.4—12.1 | 4 19.4 | 2 8 | 11 23 | 21 14 | 31 4 | | |
| RR Delphini | 38.9 | +13 35 | 10.5—11.8 | 4 14.4 | 4 10 | 13 15 | 22 19 | | | |
| Y Cygni | 48.1 | +34 17 | 7.1— 7.9 | 2 23.9 | 6 22 | 15 22 | 24 22 | | | |
| WZ Cygni | 49.3 | +38 27 | 9.9—10.8 | 0 14.0 | 5 9 | 12 23 | 20 13 | 28 4 | | |
| RR Vulpec. | 20 50.5 | +27 32 | 9.6—11.0 | 5 01.2 | 2 23 | 13 2 | 23 5 | | | |
| RY Aquarii | 21 14.8 | −11 14 | 8.8—10.4 | 1 23.2 | 5 20 | 13 17 | 21 14 | 29 11 | | |
| UZ Cygni | 55.2 | +43 52 | 8.9—11.6 | 31 07.3 | 4 8 | | | | | |
| RT Lacertæ | 21 57.4 | +43 24 | 9.1—10.5 | 5 01.7 | 2 2 | 12 6 | 17 7 | 27 11 | | |
| RW Lacertæ | 22 40.6 | +49 08 | 10.2—11.2 | 5 04.4 | 3 23 | 14 7 | 19 12 | 29 21 | | |
| VW Pegasi | 51.7 | +32 42 | 10.0—10.6 | 5 06.4 | 4 15 | 15 4 | 20 10 | 30 23 | | |
| Y Piscium | 23 29.3 | + 7 22 | 9.0—12.0 | 3 18.4 | 1 2 | 8 15 | 23 17 | 31 5 | | |
| TW Androm. | 23 58.2 | +32 17 | 8.6—11.5 | 4 02.9 | 3 0 | 11 5 | 19 11 | 27 17 | | |

## Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5$^h$; Central Standard time 6$^h$, etc.

| Star | R.A. 1900 | Decl. 1900 | Magnitude | Approx. Period | Greenwich civil times of maxima in 1927 January | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | ° ′ | | d h | d h | d h | d h | d h | d h | d h | d h | d h |
| SX Cassiop. | 0 05.5 | +54 20 | 8.6— 9.2 | 36 13.7 | | | 16 10 | | | | | |
| SY Cassiop. | 0 09.8 | +57 52 | 9.3— 9.9 | 4 01.7 | 8 19 | | 16 22 | | 25 1 | | | |
| RR Ceti | 1 27.0 | + 0 50 | 8.3— 9.0 | 0 13.3 | 6 1 | | 13 19 | | 21 13 | | 29 6 | |
| RW Cassiop. | 1 30.7 | +57 15 | 8.9—11.0 | 14 19.2 | | | 11 5 | | 26 1 | | | |
| V Arietis | 2 09.6 | +11 46 | 8.3— 9.0 | 0 23.8 | 6 11 | | 14 10 | | 22 8 | | 30 7 | |
| SU Cassiop. | 2 43.0 | +68 28 | 6.5— 7.0 | 1 22.8 | 9 16 | | 17 11 | | 25 6 | | | |
| RW Camelop. | 3 46.2 | +58 21 | 8.2— 9.4 | 16 00.0 | | | 13 8 | | 29 18 | | | |
| SX Persei | 4 10.2 | +41 27 | 10.4—11.2 | 4 07.0 | 0 16 | | 9 16 | | 17 20 | | 26 10 | |
| SV Persei | 42.8 | +42 07 | 8.8— 9.6 | 11 03.1 | 5 19 | | 16 22 | | 28 1 | | | |
| RX Aurigæ | 4 54.5 | +39 49 | 7.2— 8.1 | 11 15.0 | 3 22 | | 15 12 | | 27 4 | | | |
| SX Aurigæ | 5 04.6 | +42 02 | 8.0— 8.7 | 1 12.8 | 4 4 | | 11 19 | | 19 12 | | 27 3 | |
| SY Aurigæ | 05.5 | +42 41 | 8.4— 9.5 | 10 03.3 | 8 11 | | 18 14 | | 28 17 | | | |
| Y Aurigæ | 21.5 | +42 21 | 8.6— 9.6 | 3 20.6 | 3 8 | | 11 1 | | 18 18 | | 26 12 | |
| RZ Gemin. | 5 56.6 | +22 15 | 9.1—10.0 | 5 12.7 | 1 19 | | 12 20 | | 18 9 | | 29 10 | |
| RS Orionis | 6 16.5 | +14 44 | 8.2— 8.9 | 7 13.6 | 7 7 | | 14 20 | | 22 10 | | 30 0 | |
| T Monoc. | 19.8 | + 7 08 | 5.7— 6.8 | 27 00.3 | | | 14 10 | | | | | |
| RT Aurigæ | 23.0 | +30 33 | 5.1— 6.0 | 3 17.5 | 2 14 | | 10 1 | | 17 12 | | 24 23 | |
| W Gemin. | 29.2 | +15 24 | 6.7— 7.5 | 7 22.0 | 6 14 | | 14 12 | | 22 10 | | 30 7 | |
| ζ Gemin. | 6 58.2 | +20 43 | 3.7— 4.3 | 10 03.7 | 3 17 | | 13 21 | | 24 1 | | | |
| RU Camelop. | 7 10.9 | +69 51 | 8.5— 9.8 | 22 06.5 | | | | | 21 19 | | | |
| RR Gemin. | 7 15.2 | +31 04 | 10.0—11.5 | 0 09.5 | 7 17 | | 15 15 | | 23 14 | | 31 12 | |
| V Carinæ | 8 26.7 | —59 47 | 7.4— 8.1 | 6 16.7 | 8 4 | | 14 21 | | 21 13 | | 28 6 | |
| T Velorum | 8 34.4 | —47 01 | 7.6— 8.5 | 4 15.3 | 5 14 | | 12 5 | | 18 19 | | 25 10 | |
| V Velorum | 9 19.2 | —55 32 | 7.5— 8.2 | 4 08.9 | 1 22 | | 10 15 | | 19 9 | | 28 3 | |
| Z Leonis | 9 46.4 | +27 22 | 7.9— 9.6 | 56 08.7 | | | | | | | | |
| RR Leonis | 10 02.1 | +24 29 | 9.1—10.1 | 0 10.9 | 7 7 | | 14 2 | | 20 21 | | 27 15 | |
| SU Draconis | 11 32.2 | +67 53 | 8.9— 9.6 | 0 15.8 | 5 14 | | 12 4 | | 18 19 | | 25 10 | |
| S Muscæ | 12 07.4 | —69 36 | 6.4— 7.3 | 9 15.8 | 8 11 | | 18 3 | | 27 19 | | | |
| SW Draconis | 12.8 | +70 04 | 8.8— 9.6 | 0 13.7 | 0 23 | | 8 22 | | 16 22 | | 24 21 | |
| T Crucis | 15.9 | —61 44 | 6.8— 7.6 | 6 17.6 | 3 18 | | 10 12 | | 23 23 | | 30 17 | |
| R Crucis | 18.1 | —61 04 | 6.8— 7.9 | 5 19.8 | 2 13 | | 14 5 | | 20 1 | | 31 16 | |
| S Crucis | 12 48.4 | —57 53 | 6.5— 7.6 | 4 16.6 | 4 12 | | 13 23 | | 18 15 | | 28 1 | |
| W Virginis | 13 20.9 | — 2 52 | 8.7—10.4 | 17 06.5 | 3 21 | | | | 21 3 | | | |
| SS Hydræ | 25.0 | —23 08 | 7.4— 8.1 | 8 04.8 | 1 7 | | 9 12 | | 17 17 | | 25 22 | |
| RV Urs. Maj. | 13 29.4 | +54 31 | 9.2— 9.9 | 0 11.2 | 1 19 | | 8 20 | | 22 21 | | 29 21 | |
| ST Virginis | 14 22.5 | — 0 27 | 10.3—11.4 | 0 09.9 | 5 0 | | 12 10 | | 19 19 | | 27 5 | |
| V Centauri | 25.4 | —56 27 | 6.4— 7.8 | 5 11.9 | 1 4 | | 12 3 | | 17 15 | | 28 15 | |
| RS Bootis | 29.3 | +32 11 | 8.9—10.0 | 0 09.1 | 4 12 | | 12 1 | | 19 14 | | 27 3 | |
| R Trian.Austr. | 15 10.8 | —66 08 | 6.7— 7.4 | 3 09.3 | 3 23 | | 10 18 | | 24 7 | | 31 2 | |
| S Trian.Austr. | 15 52.2 | —63 29 | 6.4— 7.4 | 6 07.8 | 6 23 | | 13 6 | | 19 14 | | 25 22 | |
| S Normæ | 16 10.6 | —57 39 | 6.6— 7.6 | 9 18.1 | 8 17 | | 18 12 | | 28 6 | | | |
| RW Draconis | 33.7 | +58 03 | 9.6—10.8 | 0 10.6 | 3 14 | | 12 10 | | 21 7 | | 30 3 | |
| RV Scorpii | 16 51.8 | —33 27 | 6.7— 7.4 | 6 01.5 | 2 16 | | 8 18 | | 20 21 | | 26 22 | |
| X Sagittarii | 17 41.3 | —27 48 | 4.4— 5.0 | 7 00.3 | 5 2 | | 12 2 | | 19 3 | | 26 3 | |
| Y Ophiuchi | 47.3 | — 6 07 | 6.1— 6.5 | 17 02.9 | 9 22 | | | | 27 1 | | | |
| W Sagittarii | 17 58.6 | —29 35 | 4.3— 5.1 | 7 14.3 | 0 21 | | 8 11 | | 23 16 | | 31 6 | |
| Y Sagittarii | 18 15.5 | —18 54 | 5.4— 6.2 | 5 18.6 | 5 5 | | 11 0 | | 22 13 | | 28 8 | |
| U Sagittarii | 26.0 | —19 12 | 6.5— 7.3 | 6 17.9 | 3 5 | | 9 22 | | 23 10 | | 30 4 | |
| Y Scuti | 32.6 | — 8 27 | 8.7— 9.2 | 10 08.3 | 4 2 | | 14 10 | | 24 18 | | | |
| RZ Lyræ | 39.9 | +32 42 | 9.9—11.2 | 0 12.3 | 4 3 | | 11 19 | | 19 11 | | 27 3 | |
| RT Scuti | 18 44.1 | —10 30 | 9.1— 9.7 | 0 11.9 | 0 16 | | 8 2 | | 22 23 | | 30 10 | |
| κ Pavonis | 18 46.6 | —67 22 | 3.8— 5.2 | 9 02.2 | 4 7 | | 13 9 | | 22 11 | | 31 13 | |
| U Aquilæ | 19 24.0 | — 7 15 | 6.2— 6.9 | 7 00.6 | 4 20 | | 11 21 | | 18 22 | | 25 22 | |
| XZ Cygni | 19 30.4 | +56 10 | 8.6— 9.3 | 0 11.2 | 3 4 | | 10 4 | | 24 4 | | 31 4 | |

**Maxima of Variable Stars of Short Period—Continued.**

| Star | R.A. 1900 | Decl. 1900 | Magnitude | Approx. Period | Greenwich civil times of maxima in 1927 January | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | ° ′ | | d h | d h | | d h | | d h | | d h | |
| U Vulpec. | 32.2 | +20 07 | 6.5— 7.6 | 7 23.5 | 5 | 0 | 13 | 0 | 20 | 23 | 28 | 23 |
| SU Cygni | 40.8 | +29 01 | 6.2— 7.0 | 3 20.3 | 5 | 11 | 13 | 3 | 20 | 20 | 28 | 12 |
| η Aquilæ | 47.4 | + 0 45 | 3.7— 4.5 | 7 04.2 | 8 | 0 | 15 | 4 | 22 | 8 | 29 | 12 |
| S Sagittæ | 51.5 | +16 22 | 5.6— 6.4 | 8 09.2 | 2 | 16 | 11 | 1 | 19 | 10 | 27 | 19 |
| X Vulpec. | 19 53.3 | +26 17 | 9.5—10.5 | 6 07.7 | 2 | 1 | 8 | 9 | 21 | 0 | 27 | 8 |
| X Cygni | 20 39.5 | +35 14 | 6.0— 7.0 | 16 09.3 | 7 | 22 | | | 24 | 7 | | |
| T Vulpec. | 47.2 | +27 52 | 5.5— 6.1 | 4 10.5 | 0 | 13 | 9 | 10 | 18 | 7 | 27 | 4 |
| UY Cygni | 52.3 | +30 03 | 9.6—10.4 | 0 13.5 | 3 | 14 | 10 | 21 | 18 | 4 | 25 | 11 |
| RV Capric. | 55.9 | —15 37 | 9.2—10.1 | 0 10.7 | 2 | 16 | 9 | 19 | 24 | 3 | 31 | 7 |
| TX Cygni | 20 56.4 | +42 12 | 8.5— 9.7 | 14 17.4 | | | 14 | 13 | 29 | 6 | | |
| VY Cygni | 21 00.4 | +39 34 | 8.8— 9.5 | 7 20.6 | 2 | 1 | 9 | 21 | 17 | 18 | 25 | 15 |
| SW Aquarii | 10.2 | — 0 20 | 9.9—10.8 | 0 11.0 | 2 | 19 | 9 | 16 | 23 | 11 | 30 | 8 |
| VZ Cygni | 21 47.7 | +42 40 | 8.2— 9.2 | 4 20.7 | 2 | 13 | 12 | 6 | 22 | 0 | 31 | 17 |
| Y Lacertæ | 22 05.2 | +50 33 | 9.1— 9.6 | 4 07.8 | 1 | 22 | 10 | 14 | 19 | 6 | 27 | 21 |
| δ Cephei | 25.5 | +57 54 | 3.7— 4.6 | 5 08.8 | 6 | 9 | 11 | 17 | 22 | 11 | 27 | 20 |
| Z Lacertæ | 36.9 | +56 18 | 8.2— 9.0 | 10 21.1 | 9 | 18 | 20 | 15 | 31 | 12 | | |
| RR Lacertæ | 37.5 | +55 55 | 8.5— 9.2 | 6 10.1 | 4 | 0 | 10 | 0 | 23 | 6 | 29 | 16 |
| V Lacertæ | 44.5 | +55 48 | 8.5— 9.5 | 4 23.6 | 3 | 19 | 13 | 19 | 23 | 18 | | |
| X Lacertæ | 22 45.0 | +55 54 | 8.2— 8.6 | 5 10.7 | 4 | 4 | 15 | 1 | 20 | 12 | 31 | 9 |
| SW Cassiop. | 23 03.7 | +58 11 | 9.2— 9.7 | 5 10.6 | 6 | 3 | 11 | 14 | 22 | 11 | 27 | 22 |
| RS Cassiop. | 32.6 | +61 52 | 9.0—11.0 | 6 07.1 | 2 | 2 | 8 | 9 | 20 | 23 | 27 | 6 |
| RY Cassiop. | 47.2 | +58 11 | 9.3—11.8 | 12 03.4 | 10 | 7 | 22 | 10 | | | | |
| V Cephei | 23 51.7 | +82 38 | 6.0— 7.0 | 0 23.9 | 2 | 6 | 9 | 5 | 23 | 5 | 30 | 4 |

## Monthly Report of the American Association of Variable Star Observers, for the Month ending October 31, 1926.

The outstanding event of interest to our members was the Fifteenth Annual Meeting held at the Harvard Observatory on October 23, 1926. Approximately 100 members and their guests were in attendance, and there was something doing from early morning to late night on that eventful day.

Following a short business meeting when reports of officers and committees were read, a very creditable list of papers was presented. The reports of the various committees indicated a very active condition of affairs in the Association.

Most of the papers presented dealt with variable star matters although they were not confined to that topic. Dr. Hertzsprung, associate director of the observatory at Leiden, presented a very timely paper dealing with the relation of periods to form of light curves for Cepheid variables. The principal address of the afternoon session was by Mr. George R. Aggassiz, who took for his subject, "The Meteor Crater." His handling of the topic indicated his thorough knowledge of the matter under discussion and revealed a large field of research possible in connection therewith. Dr. P. W. Merrill communicated a paper entitled, "Long Period Variables as Physical Laboratories." Miss L. B. Allen discussed the changes in spectra on long period variables, and Mr. Campbell commented at some length on the particularly interesting irregular variables under observation during the past year by the active members. President Yalden delivered a very scientific paper dealing with the graphical methods used in the calculation of times of occultations. The visiting astronomers, members of the Neighborhood Club, took an active part in the various discussions, and on the whole the meeting took on a more scientific aspect than any of the previous meetings.

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926.

Aug. 0 = J. D. 2424728; Sept. 0 = J. D. 2424759; Oct. 0 = J. D. 2424789.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| *001032* S SCULPTORIS— | | | | | | |
| | 4734.4 | 9.6 | Ht | 4749.0 | 8.8 | Bl |
| | 4735.3 | 9.7 | Sm | 4754.3 | 9.1 | Ht |
| | 4743.3 | 9.1 | Ht | 4758.3 | 8.9 | Sm |
| | 4746.3 | 9.1 | Sm | 4800.5 | 6.9 | Pt |
| 001046 X ANDROMEDAE— | | | | | | |
| | 4786.6 | 10.5 | O | 4797.6 | 10.3 | Pw |
| | 4794.5 | 10.7 | Cl | 4800.6 | 10.4 | Hu |
| | 4795.6 | 10.4 | B | | | |
| *001620* T CETI— | | | | | | |
| | 4763.6 | 6.8 | L | 4777.6 | 6.6 | L |
| | 4770.6 | 6.6 | L | | | |
| 001726 T ANDROMEDAE— | | | | | | |
| | 4756.2 | 11.2 | Ch | 4786.6 | 12.5 | B |
| | 4786.6 | 12.2 | O | 4800.5 | 12.6 | Pt |
| 001755 T CASSIOPEIAE— | | | | | | |
| | 4763.6 | 12.2 | L | 4793.6 | 11.7 | Bx |
| | 4775.3 | 12.1 | L | 4798.6 | 11.8 | Bx |
| | 4786.6 | 11.9 | B | 4800.5 | 11.8 | Pt |
| 001838 R ANDROMEDAE— | | | | | | |
| | 4756.2 | 8.6 | Ch | 4798.5 | 10.5 | Bx |
| | 4772.4 | 9.5 | Lp | 4800.5 | 10.6 | Pt |
| | 4786.6 | 9.5 | B | 4800.6 | 10.2 | Ie |
| | 4792.5 | 9.7 | Lp | 4804.5 | 9.9 | B |
| | 4794.5 | 10.0 | Bx | | | |
| *001909* S CETI— | | | | | | |
| | 4763.6 | 9.9 | L | 4784.6 | 10.9 | L |
| | 4764.2 | 10.0 | Ch | 4800.5 | 12.1 | Pt |
| | 4770.6 | 10.2 | L | | | |
| *002546* T PHOENICIS— | | | | | | |
| | 4735.3 | 9.2 | Sm | 4749.1 | 9.0 | Bl |
| | 4746.3 | 9.5 | Sm | 4758.3 | 9.5 | Sm |
| 003179 Y CEPHEI— | | | | | | |
| | 4797.6 | 10.6 | B | | | |
| 004047 U CASSIOPEIAE— | | | | | | |
| | 4786.6 | 13.4 | B | | | |
| 004435 V ANDROMEDAE— | | | | | | |
| | 4786.6 | 13.3 | B | | | |
| 004533 RR ANDROMEDAE— | | | | | | |
| | 4785.6 | 12.8 | B | | | |
| 004746a RV CASSIOPEIAE— | | | | | | |
| | 4791.6 | 11.9 | B | 4800.5 | 12.2 | Pt |
| | 4793.6 | 11.5 | O | | | |
| 004746b — CASSIOPEIAE— | | | | | | |
| | 4800.5 | 10.6 | Pt | | | |
| 004958 W CASSIOPEIAE— | | | | | | |
| | 4772.4 | 8.5 | Lp | 4791.6 | 9.1 | O |
| | 4783.4 | 8.9 | Lp | 4792.5 | 9.4 | Lp |
| | 4786.6 | 8.5 | B | 4800.5 | 9.0 | Pt |
| *005475* U TUCANAE— | | | | | | |
| | 4741.3 | [11.8 | En | 4755.3 | [11.8 | En |
| 005840 RX ANDROMEDAE— | | | | | | |
| | 4784.8 | 11.1 | Pt | 4796.6 | 11.4 | Pt |
| | 4789.8 | 13.0 | Pt | 4800.5 | 12.2 | Pt |
| | 4791.5 | [11.7 | Pt | 4802.7 | [11.7 | Pt |
| | 4792.5 | [12.4 | Pt | 4803.8 | [12.4 | Pt |
| | 4794.5 | [12.4 | Pt | 4804.7 | [11.5 | Pt |
| | 4795.8 | 12.5 | Pt | 4805.8 | [11.5 | Pt |
| *010103* Z CETI— | | | | | | |
| | 4802.7 | 10.5 | Pt | 4803.6 | 9.8 | Pt |
| *010630* U SCULPTORIS— | | | | | | |
| | 4749.1 | 9.9 | Bl | | | |
| 010940 U ANDROMEDAE— | | | | | | |
| | 4803.5 | [13.1 | B | | | |
| 011041 UZ ANDROMEDAE— | | | | | | |
| | 4791.6 | 9.5 | B | | | |
| 011208 S PISCIUM— | | | | | | |
| | 4802.6 | 13.8 | B | | | |
| 011272 S CASSIOPEIAE— | | | | | | |
| | 4772.5 | 11.6 | Lp | 4792.4 | 12.0 | Lp |
| | 4786.6 | 12.0 | B | 4800.6 | 12.0 | Ie |
| 012350 RZ PERSEI— | | | | | | |
| | 4802.6 | 12.5 | B | | | |
| 013238 RU ANDROMEDAE— | | | | | | |
| | 4764.2 | 10.0 | Ch | 4786.7 | 10.9 | B |
| | 4786.6 | 10.8 | O | 4802.7 | 11.0 | Pt |
| 013338 Y ANDROMEDAE— | | | | | | |
| | 4764.2 | 9.3 | Ch | 4786.7 | 9.5 | B |
| | 4786.6 | 9.8 | O | 4802.6 | 11.1 | Pt |
| 014958 X CASSIOPEIAE— | | | | | | |
| | 4763.4 | 12.6 | Bn | 4791.3 | 12.4 | Bn |
| | 4769.4 | 12.3 | Bn | 4799.4 | 13.7 | Bn |
| | 4785.3 | 12.4 | Bn | 4802.7 | 12.0 | Pt |
| | 4786.7 | 10.8 | B | | | |
| 015254 U PERSEI— | | | | | | |
| | 4799.6 | 8.8 | O | 4802.6 | 9.2 | B |
| | 4800.6 | 8.9 | Hu | 4802.7 | 8.5 | Pt |
| 015912 S ARIETIS— | | | | | | |
| | 4803.6 | [13.8 | B | | | |
| 021024 R ARIETIS— | | | | | | |
| | 4790.4 | [13.2 | Lp | 4802.7 | 11.2 | Pt |
| | 4793.4 | 12.1 | Lp | 4803.6 | 11.5 | B |
| | 4800.6 | 11.5 | Ie | | | |
| 021143a W ANDROMEDAE— | | | | | | |
| | 4791.6 | 13.5 | B | 4802.7 | 12.5 | Pt |
| 021258 T PERSEI— | | | | | | |
| | 4765.2 | 8.7 | Ch | 4804.6 | 9.0 | Ms |
| | 4802.7 | 8.4 | Pt | | | |
| 021281 Z CEPHEI— | | | | | | |
| | 4803.7 | [13.5 | B | | | |
| *021403* o CETI— | | | | | | |
| | 4763.6 | 7.2 | L | 4792.7 | 3.3 | Jo |
| | 4765.3 | 7.0 | Ch | 4794.5 | 3.1 | Lp |
| | 4770.6 | 5.6 | L | 4797.7 | 3.4 | Pw |
| | 4770.5 | 5.3 | Lp | 4798.6 | 3.5 | Jo |
| | 4772.2 | 5.5 | Ch | 4800.6 | 3.5 | Hu |
| | 4777.6 | 4.5 | L | 4802.7 | 3.1 | Pt |
| | 4784.6 | 3.6 | L | 4803.7 | 3.4 | Pw |
| | 4785.7 | 4.0 | Pw | 4803.7 | 3.3 | B |
| | 4791.5 | 3.5 | Lp | 4804.6 | 3.4 | Jo |
| 021558 S PERSEI— | | | | | | |
| | 4765.2 | 8.8 | Ch | 4793.3 | 9.1 | Kl |
| | 4771.3 | 9.0 | Kl | 4800.6 | 8.5 | Hu |
| | 4782.3 | 9.3 | Kl | 4802.7 | 8.3 | B |
| | 4788.3 | 9.2 | Kl | 4802.7 | 8.2 | Pt |
| | 4792.5 | 9.1 | Lp | 4804.6 | 8.6 | Ms |
| 022150 RR PERSEI— | | | | | | |
| | 4802.7 | 13.1 | B | | | |
| *022813* U CETI— | | | | | | |
| | 4769.2 | 7.6 | Ch | 4802.7 | 7.4 | Pt |

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926—Continued.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| 022980 RR CEPHEI— | | | | | | |
| | 4802.7 | 9.0 | Pt | | | |
| 023133 R TRIANGULI— | | | | | | |
| | 4764.2 | 10.8 | Ch | 4802.7 | 11.9 | Pt |
| | 4786.6 | 11.6 | O | 4803.6 | 12.0 | B |
| | 4800.6 | 12.3 | Ie | | | |
| 024217 T ARIETIS— | | | | | | |
| | 4520.0 | 8.7 | Nk | 4531.0 | 8.9 | Nk |
| | 4523.0 | 8.7 | Nk | 4559.0 | 8.5 | Nk |
| 024356 W PERSEI— | | | | | | |
| | 4519.9 | 9.1 | Nk | 4610.0 | 9.2 | Nk |
| | 4522.0 | 9.2 | Nk | 4619.0 | 9.1 | Nk |
| | 4527.0 | 9.1 | Nk | 4620.0 | 9.1 | Nk |
| | 4529.0 | 9.2 | Nk | 4704.3 | 8.9 | Nk |
| | 4531.0 | 9.1 | Nk | 4705.3 | 9.0 | Nk |
| | 4537.0 | 9.1 | Nk | 4706.3 | 9.0 | Nk |
| | 4538.0 | 9.2 | Nk | 4712.3 | 9.0 | Nk |
| | 4539.3 | 9.1 | Nk | 4779.6 | 9.7 | O |
| | 4549.0 | 9.1 | Nk | 4793.6 | 9.2 | Cl |
| | 4559.0 | 9.1 | Nk | 4794.5 | 9.2 | Bx |
| | 4560.0 | 9.1 | Nk | 4798.5 | 9.0 | Bx |
| | 4561.9 | 9.1 | Nk | 4802.7 | 9.3 | B |
| | 4581.9 | 9.2 | Nk | 4802.7 | 9.0 | Pt |
| | 4583.0 | 9.2 | Nk | 4806.5 | 9.2 | Bx |
| | 4595.0 | 9.2 | Nk | | | |
| *025050* R HOROLOGII— | | | | | | |
| | 4734.4 | 11.8 | Ht | 4754.4 | 11.8 | Ht |
| | 4749.1 | 11.6 | Bl | 4758.3 | 11.8 | Sm |
| *025751* T HOROLOGII— | | | | | | |
| | 4749.1 | 10.7 | Bl | 4758.3 | 10.2 | Sm |
| *021401* X CETI— | | | | | | |
| | 4521.9 | 9.6 | Nk | 4763.6 | 10.9 | L |
| | 4523.0 | 9.1 | Nk | 4770.6 | 11.2 | L |
| | 4531.0 | 9.1 | Nk | 4777.7 | 11.2 | L |
| | 4559.0 | 9.8 | Nk | 4802.7 | 11.9 | Pt |
| 032043 Y PERSEI— | | | | | | |
| | 4520.0 | 8.7 | Nk | 4610.0 | 10.1 | Nk |
| | 4531.0 | 8.9 | Nk | 4700.3 | 9.2 | Nk |
| | 4559.0 | 8.7 | Nk | 4779.6 | 9.0 | O |
| | 4582.0 | 8.9 | Nk | 4800.6 | 8.1 | Hu |
| | 4595.0 | 9.1 | Nk | 4802.7 | 8.2 | Pt |
| 032335 R PERSEI— | | | | | | |
| | 4767.4 | 9.2 | Lp | 4792.5 | 9.3 | Lp |
| | 4772.4 | 8.4 | Lp | 4800.6 | 8.9 | Hu |
| | 4783.4 | 8.6 | Lp | 4802.7 | 9.7 | Pt |
| 042209 R TAURI— | | | | | | |
| | 4769.8 | 13.8 | Pt | | | |
| 042215 W TAURI— | | | | | | |
| | 4802.8 | 11.0 | Sg | 4802.7 | 10.9 | Pt |
| 043065 T CAMELOPARDALIS— | | | | | | |
| | 4768.4 | 8.7 | L | 4790.6 | 9.6 | Jo |
| | 4777.6 | 8.7 | L | 4802.7 | 9.0 | Pt |
| | 4781.6 | 9.3 | O | | | |
| *043263* R RETICULI— | | | | | | |
| | 4749.1 | 9.9 | Bl | 4758.4 | 10.4 | Sm |
| | 4754.4 | 10.4 | Ht | | | |
| 043274 X CAMELOPARDALIS— | | | | | | |
| | 4791.6 | 10.6 | O | 4802.7 | 9.5 | Pt |
| *043562* R DORADUS— | | | | | | |
| | 4749.1 | 5.5 | Bl | 4758.4 | 5.8 | Sm |
| | 4754.4 | 5.8 | Ht | | | |
| *044349* R PICTORIS— | | | | | | |
| | 4749.1 | 6.5 | Bl | | | |
| 044617 V TAURI— | | | | | | |
| | 4770.6 | 9.9 | Lp | 4802.8 | 12.0 | Pt |
| | 4794.5 | 12.0 | Lp | | | |
| *045514* R LEPORIS— | | | | | | |
| | 4763.6 | 8.6 | L | 4784.6 | 9.6 | L |
| | 4770.6 | 8.4 | L | 4802.8 | 8.9 | Pt |
| | 4777.6 | 8.8 | L | | | |
| 050003 V ORIONIS— | | | | | | |
| | 4802.8 | 13.5 | Pt | | | |
| *050022* T LEPORIS— | | | | | | |
| | 4802.8 | 11.5 | Pt | | | |
| 050953 R AURIGAE— | | | | | | |
| | 4802.8 | 8.2 | Pt | | | |
| 052034 S AURIGAE— | | | | | | |
| | 4802.8 | 8.5 | Pt | | | |
| 052036 W AURIGAE— | | | | | | |
| | 4802.8 | 8.4 | Pt | | | |
| *052404* S ORIONIS— | | | | | | |
| | 4802.8 | 11.8 | Pt | | | |
| *053005a* T ORIONIS— | | | | | | |
| | 4522.0 | 11.1 | Nk | 4772.6 | 11.3 | L |
| | 4523.0 | 11.2 | Nk | 4777.6 | 11.3 | L |
| | 4525.9 | 11.6 | Nk | 4784.6 | 11.6 | L |
| | 4531.0 | 11.1 | Nk | 4784.8 | 10.7 | Pt |
| | 4558.0 | 10.5 | Nk | 4792.8 | 10.5 | Pt |
| | 4559.0 | 10.4 | Nk | 4795.8 | 10.6 | Pt |
| | 4561.0 | 10.4 | Nk | 4798.7 | 10.3 | Pt |
| | 4582.1 | 11.0 | Nk | 4802.8 | 10.6 | Pt |
| | 4595.0 | 10.5 | Nk | 4803.8 | 10.5 | Pt |
| | 4763.6 | 11.4 | L | 4805.8 | 9.8 | Pt |
| | 4770.6 | 11.3 | L | | | |
| 053068 S CAMELOPARDALIS— | | | | | | |
| | 4781.6 | 8.8 | O | 4795.7 | 8.8 | Pc |
| | 4792.7 | 8.9 | Jo | 4802.8 | 8.4 | Pt |
| 053337 RU AURIGAE— | | | | | | |
| | 4795.7 | 9.3 | Pc | 4802.8 | 9.3 | Pt |
| 053531 U AURIGAE— | | | | | | |
| | 4802.9 | 8.1 | Pt | | | |
| 054319 SU TAURI— | | | | | | |
| | 4763.6 | 9.7 | L | 4792.8 | 9.5 | Pt |
| | 4769.4 | 10.2 | Ch | 4795.8 | 9.6 | Pt |
| | 4770.6 | 9.7 | L | 4796.7 | 9.5 | Pt |
| | 4772.6 | 9.7 | L | 4802.9 | 9.6 | Pt |
| | 4777.6 | 9.6 | L | 4803.8 | 9.6 | Pt |
| | 4778.5 | 9.8 | Ch | 4804.7 | 9.6 | Pt |
| | 4784.6 | 9.5 | L | 4805.8 | 9.6 | Pt |
| | 4784.8 | 9.6 | Pt | | | |
| 054920a U ORIONIS— | | | | | | |
| | 4520.0 | 10.0 | Nk | 4583.1 | 12.0 | Nk |
| | 4522.0 | 10.3 | Nk | 4595.0 | 12.2 | Nk |
| | 4523.0 | 10.4 | Nk | 4644.0 | 11.3 | Nk |
| | 4531.0 | 10.7 | Nk | 4769.4 | 6.0 | Ch |
| | 4538.1 | 11.0 | Nk | 4770.5 | 6.6 | Lp |
| | 4559.0 | 11.0 | Nk | 4794.5 | 6.7 | Lp |
| | 4561.0 | 11.6 | Nk | 4802.9 | 6.0 | Pt |
| | 4582.1 | 12.0 | Nk | | | |
| 055353 Z AURIGAE— | | | | | | |
| | 4784.8 | 10.0 | Pt | 4795.8 | 9.7 | Pt |
| | 4789.7 | 9.9 | Pt | 4796.7 | 9.6 | Pt |

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926—Continued.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| 055353 Z AURIGAE—Continued. | | | | | | |
| | 4792.8 | 10.0 | Pt | 4798.7 | 9.8 | Pt |
| | 4794.6 | 10.0 | Pt | 4802.8 | 9.8 | Pt |
| 060450 X AURIGAE— | | | | | | |
| | 4769.4 | 10.1 | Ch | 4802.8 | 11.4 | Pt |
| 060547 SS AURIGAE— | | | | | | |
| | 4763.6 | [14.5 | L | 4792.8 | [12.6 | Pt |
| | 4769.4 | [11.6 | Ch | 4794.6 | [12.4 | Pt |
| | 4767.4 | [12.4 | L | 4795.8 | [12.6 | Pt |
| | 4770.6 | [15.0 | L | 4796.7 | [12.6 | Pt |
| | 4772.6 | 10.8 | L | 4798.7 | [12.4 | Pt |
| | 4776.4 | 12.4 | L | 4802.8 | [12.6 | Pt |
| | 4777.6 | 13.5 | L | 4803.8 | [12.4 | Pt |
| | 4778.5 | [10.1 | Ch | 4804.7 | [11.5 | Pt |
| | 4784.8 | [10.0 | Pt | 4805.8 | 11.5 | Pt |
| *061702* V MONOCEROTIS— | | | | | | |
| | 4802.9 | 11.4 | Pt | | | |
| 063308 R MONOCEROTIS— | | | | | | |
| | 4802.9 | 10.6 | Pt | | | |
| 063558 S LYNCIS— | | | | | | |
| | 4802.9 | 10.4 | Pt | | | |
| *064707* W MONOCEROTIS— | | | | | | |
| | 4802.9 | 9.4 | Pt | | | |
| 065111 Y MONOCEROTIS— | | | | | | |
| | 4802.9 | 12.5 | Pt | | | |
| *065208* X MONOCEROTIS— | | | | | | |
| | 4763.6 | 9.0 | L | 4777.7 | 8.5 | L |
| | 4770.6 | 8.9 | L | 4784.6 | 8.5 | L |
| 065355 R LYNCIS— | | | | | | |
| | 4802.9 | 9.8 | Pt | | | |
| 070122a R GEMINORUM— | | | | | | |
| | 4802.9 | 9.8 | Pt | | | |
| 070122b TW GEMINORUM— | | | | | | |
| | 4802.9 | 8.1 | Pt | | | |
| 070122c Z GEMINORUM— | | | | | | |
| | 4802.9 | 12.4 | Pt | | | |
| 070310 R CANIS MINORIS— | | | | | | |
| | 4763.6 | 8.3 | L | 4777.7 | 8.0 | L |
| | 4770.6 | 8.0 | L | 4784.6 | 7.6 | L |
| 071713 V GEMINORUM— | | | | | | |
| | 4802.9 | 8.7 | Pt | | | |
| 072708 S CANIS MINORIS— | | | | | | |
| | 4763.6 | 11.9 | L | 4777.6 | 11.7 | L |
| | 4770.6 | 11.9 | L | 4802.9 | 10.5 | Pt |
| *073173* S VOLANTIS— | | | | | | |
| | 4754.9 | [13.2 | Bl | | | |
| 073508 U CANIS MINORIS— | | | | | | |
| | 4763.6 | 10.7 | L | 4777.6 | 11.0 | L |
| | 4770.6 | 11.0 | L | 4802.9 | 12.2 | Pt |
| 073723 S GEMINORUM— | | | | | | |
| | 4802.9 | 10.5 | Pt | | | |
| 074323 T GEMINORUM— | | | | | | |
| | 4802.9 | 9.3 | Pt | | | |
| 074922 U GEMINORUM— | | | | | | |
| | 4763.6 | 8.9 | L | 4792.8 | [12.4 | Pt |
| | 4769.4 | 9.0 | Ch | 4794.5 | [12.3 | Lp |
| | 4770.6 | 9.7 | L | 4795.8 | [12.4 | Pt |
| | 4772.6 | 10.6 | L | 4802.8 | [12.4 | Pt |
| | 4777.6 | 13.5 | L | 4803.8 | [12.4 | Pt |
| | 4778.4 | [10.9 | Ch | 4805.8 | [11.3 | Pt |
| 081112 R CANCRI— | | | | | | |
| | 4583.0 | 7.5 | H | 4612.0 | 7.1 | H |
| | 4584.0 | 7.7 | H | 4613.0 | 7.2 | H |
| | 4587.0 | 7.2 | H | 4763.6 | 10.6 | L |
| | 4506.0 | 7.1 | H | 4770.6 | 10.7 | L |
| | 4607.0 | 6.9 | H | 4777.6 | 10.7 | L |
| | 4611.0 | 7.2 | H | 4802.9 | 11.5 | Pt |
| 081617 V CANCRI— | | | | | | |
| | 4802.9 | 10.9 | Pt | | | |
| *082476* R CHAMAELEONTIS— | | | | | | |
| | 4734.3 | 11.0 | Sm | 4748.9 | 11.4 | Bl |
| | 4740.9 | 11.3 | Bl | 4758.3 | 12.4 | Sm |
| 083350 X URSAE MAJORIS— | | | | | | |
| | 4802.9 | 10.9 | Pt | | | |
| 084803 S HYDRAE— | | | | | | |
| | 4778.5 | 10.5 | Ch | 4802.9 | 11.2 | Pt |
| *085008* T HYDRAE— | | | | | | |
| | 4802.9 | 12.7 | Pt | | | |
| 085120 T CANCRI— | | | | | | |
| | 4802.9 | 8.6 | Pt | | | |
| 090151 V URSAE MAJORIS— | | | | | | |
| | 4520.0 | 10.4 | Nk | 4559.0 | 10.3 | Nk |
| | 4523.0 | 10.4 | Nk | 4582.1 | 10.3 | Nk |
| | 4529.1 | 10.3 | Nk | 4595.0 | 10.3 | Nk |
| | 4531.0 | 10.3 | Nk | 4644.0 | 10.3 | Nk |
| | 4532.3 | 10.4 | Nk | 4674.0 | 10.7 | Nk |
| | 4541.0 | 10.3 | Nk | 4695.1 | 10.6 | Nk |
| *092962* R CARINAE— | | | | | | |
| | 4731.2 | 5.7 | En | 4743.2 | 5.8 | En |
| | 4733.2 | 5.5 | Ht | 4746.2 | 5.7 | Sm |
| | 4734.2 | 5.7 | Sm | 4748.9 | 5.8 | Bl |
| | 4740.9 | 5.6 | Bl | 4749.2 | 5.8 | Ht |
| | 4741.2 | 5.7 | Ht | 4754.2 | 6.6 | Ht |
| *093014* X HYDRAE— | | | | | | |
| | 4802.9 | 9.7 | Pt | | | |
| 093934 R LEONIS MINORIS— | | | | | | |
| | 4802.9 | 11.8 | Pt | | | |
| 094211 R LEONIS— | | | | | | |
| | 4553.0 | 6.2 | H | 4584.0 | 6.1 | H |
| | 4558.0 | 6.2 | H | 4586.0 | 6.1 | H |
| | 4559.0 | 6.0 | H | 4587.0 | 6.2 | H |
| | 4560.0 | 6.1 | H | 4604.0 | 6.2 | H |
| | 4562.0 | 6.1 | H | 4606.0 | 6.2 | H |
| | 4563.0 | 6.1 | H | 4609.0 | 6.3 | H |
| | 4577.0 | 6.2 | H | 4611.0 | 6.4 | H |
| | 4581.0 | 6.2 | H | 4613.0 | 6.4 | H |
| | 4582.0 | 6.2 | H | 4778.4 | 9.9 | Ch |
| | 4583.0 | 6.1 | H | 4802.9 | 8.2 | Pt |
| *094952* Z VELORUM— | | | | | | |
| | 4731.2 | [12.1 | En | | | |
| 095421 V LEONIS— | | | | | | |
| | 4802.9 | 13.0 | Pt | | | |
| *095562* RV CARINAE— | | | | | | |
| | 4741.9 | [13.1 | Bl | 4754.9 | [13.1 | Bl |
| *100661* S CARINAE— | | | | | | |
| | 4729.3 | 6.5 | Sm | 4746.2 | 6.0 | Sm |
| | 4731.2 | 6.4 | En | 4748.9 | 5.5 | Bl |
| | 4733.2 | 6.5 | Ht | 4749.2 | 6.0 | Ht |
| | 4734.3 | 6.5 | Sm | 4754.2 | 6.1 | En |
| | 4738.2 | 6.3 | En | 4754.2 | 5.8 | Ht |
| | 4740.9 | 5.8 | Bl | 4758.2 | 5.8 | Sm |

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926—Continued.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| *100661* S CARINAE—Continued. | | | | | | |
| | 4741.2 | 6.2 | Ht | 4759.2 | 5.8 | En |
| | 4743.3 | 6.3 | En | | | |
| *101058* Z CARINAE— | | | | | | |
| | 4731.2 | [12.3 | En | 4738.2 | [12.3 | En |
| 103769 R URSAE MAJORIS— | | | | | | |
| | 4777.6 | 7.9 | Pc | 4805.9 | 8.5 | Pt |
| | 4802.5 | 8.5 | Mh | | | |
| *104620* W HYDRAE— | | | | | | |
| | 4748.9 | 8.7 | Bl | | | |
| *104628* RS HYDRAE— | | | | | | |
| | 4748.9 | 11.8 | Bl | | | |
| *110361* RS CARINAE— | | | | | | |
| | 4731.2 | [12.1 | En | 4738.2 | [12.1 | En |
| *111561* RY CARINAE— | | | | | | |
| | 4754.9 | [13.1 | Bl | | | |
| *111661* RS CENTAURI— | | | | | | |
| | 4729.3 | 9.9 | Sm | 4746.2 | 10.6 | Sm |
| | 4734.3 | 9.9 | Sm | 4748.9 | 10.1 | Bl |
| | 4740.9 | 9.9 | Bl | 4758.2 | 11.6 | Sm |
| *114441* X CENTAURI— | | | | | | |
| | 4740.9 | 9.5 | Bl | 4748.9 | 9.7 | Bl |
| *115058* W CENTAURI— | | | | | | |
| | 4744.3 | [11.2 | En | 4754.9 | 12.6 | Bl |
| | 4754.3 | [11.7 | En | 4759.2 | [12.2 | En |
| 122532 T CANUM VENATICORUM— | | | | | | |
| | 4767.4 | 9.8 | Lp | 4805.9 | 9.7 | Pt |
| *122854* U CENTAURI— | | | | | | |
| | 4740.9 | 8.4 | Bl | 4748.9 | 8.3 | Bl |
| 123160 T URSAE MAJORIS— | | | | | | |
| | 4794.5 | 10.8 | Lp | 4802.5 | 10.6 | Mh |
| | 4800.7 | 10.7 | Sg | 4805.9 | 10.0 | Pt |
| 123459 RS URSAE MAJORIS— | | | | | | |
| | 4754.1 | 8.7 | Ch | 4802.5 | 10.9 | Mh |
| | 4781.7 | 10.9 | Sg | 4805.9 | 11.4 | Pt |
| | 4800.7 | 10.9 | Sg | | | |
| 123961 S URSAE MAJORIS— | | | | | | |
| | 4767.3 | 8.9 | Kl | 4785.3 | 10.4 | Kl |
| | 4767.4 | 8.9 | L | 4785.6 | 9.8 | Pw |
| | 4771.3 | 9.0 | Kl | 4788.3 | 10.4 | Kl |
| | 4773.3 | 9.1 | Kl | 4789.3 | 10.5 | Kl |
| | 4776.3 | 8.7 | L | 4793.3 | 10.5 | Kl |
| | 4777.6 | 9.4 | Pc | 4793.4 | 10.5 | Lp |
| | 4778.4 | 9.4 | Kl | 4793.5 | 10.4 | Bx |
| | 4780.5 | 9.5 | Bx | 4798.5 | 11.0 | Bx |
| | 4781.7 | 10.1 | Sg | 4800.7 | 10.8 | Sg |
| | 4782.3 | 9.9 | Kl | 4802.5 | 11.3 | Mh |
| | 4783.4 | 10.2 | Lp | 4805.9 | 11.0 | Pt |
| *131283* U OCTANTIS— | | | | | | |
| | 4729.2 | 5.1 | Sm | 4744.3 | 5.5 | En |
| | 4731.3 | 5.1 | En | 4748.9 | 5.4 | Bl |
| | 4735.2 | 5.1 | En | 4754.3 | 5.6 | En |
| | 4735.2 | 5.3 | Sm | 4759.2 | 5.8 | En |
| | 4740.9 | 5.0 | Bl | | | |
| *132706* S VIRGINIS— | | | | | | |
| | 4729.3 | 9.3 | Sm | 4746.2 | 9.6 | Sm |
| | 4734.3 | 9.4 | Sm | 4758.2 | 9.5 | Sm |
| *133155* RV CENTAURI— | | | | | | |
| | 4740.9 | 9.5 | Bl | 4748.9 | 9.5 | Bl |
| *133633* T CENTAURI— | | | | | | |
| | 4729.3 | 7.4 | Sm | 4746.3 | 7.8 | Sm |
| | 4731.3 | 7.9 | En | 4748.9 | 7.5 | Bl |
| | 4733.3 | 8.0 | Ht | 4749.2 | 7.8 | Ht |
| | 4734.3 | 7.8 | Sm | 4754.2 | 7.4 | Ht |
| | 4738.2 | 8.2 | Ht | 4754.3 | 7.9 | En |
| | 4740.9 | 7.8 | Bl | 4758.2 | 8.8 | En |
| | 4741.3 | 8.4 | Ht | 4758.3 | 6.9 | Sm |
| | 4743.3 | 8.2 | Ht | 4759.2 | 7.1 | En |
| | 4745.2 | 8.2 | En | | | |
| *134236* RT CENTAURI— | | | | | | |
| | 4740.9 | 10.1 | Bl | 4748.9 | 10.9 | Bl |
| 134440 R CANUM VENATICORUM— | | | | | | |
| | 4792.5 | 7.1 | Pt | 4794.5 | 7.5 | Bx |
| | 4793.5 | 7.8 | Bx | 4798.5 | 9.8 | Bx |
| *134536* RX CENTAURI— | | | | | | |
| | 4740.9 | 9.9 | Bl | 4748.9 | 10.5 | Bl |
| *134677* T APODIS— | | | | | | |
| | 4754.9 | [13.2 | Bl | | | |
| *140528* RU HYDRAE— | | | | | | |
| | 4734.2 | [12.0 | En | 4755.2 | [12.0 | En |
| *140959* R CENTAURI— | | | | | | |
| | 4729.3 | 8.1 | Sm | 4748.9 | 7.5 | Bl |
| | 4731.3 | 8.0 | En | 4749.2 | 7.9 | Ht |
| | 4733.2 | 8.5 | Ht | 4754.2 | 7.5 | Ht |
| | 4735.3 | 8.3 | Sm | 4754.3 | 7.3 | Sm |
| | 4738.3 | 8.4 | En | 4754.3 | 8.0 | En |
| | 4740.9 | 7.5 | Bl | 4758.0 | 7.1 | Bl |
| | 4741.2 | 8.5 | Ht | 4759.2 | 7.3 | Sm |
| | 4743.3 | 8.1 | En | 4759.3 | 7.9 | En |
| | 4746.3 | 7.5 | Sm | | | |
| 141567 U URSAE MINORIS— | | | | | | |
| | 4755.1 | 9.7 | Ch | 4791.5 | 9.0 | Pt |
| | 4777.6 | 9.2 | Pc | 4799.2 | 9 0. | Gs |
| 141954 S BOOTIS— | | | | | | |
| | 4772.3 | 13.6 | L | 4791.5 | 13.3 | Pt |
| 142539a V BOOTIS— | | | | | | |
| | 4754.1 | 8.0 | Ch | 4783.4 | 8.8 | Lp |
| | 4765.4 | 7.9 | L | 4784.4 | 8.5 | L |
| | 4775.3 | 8.2 | L | 4791.5 | 8.6 | Pt |
| | 4777.6 | 8.4 | Pc | 4793.4 | 8.9 | Lp |
| 142584 R CAMELOPARDALIS— | | | | | | |
| | 4774.4 | 10.5 | Lp | 4792.4 | 10.0 | Lp |
| | 4783.4 | 10.3 | Lp | 4795.6 | 9.3 | B |
| 143227 R BOOTIS— | | | | | | |
| | 4791.6 | 9.6 | Pt | | | |
| *145254* Y LUPI— | | | | | | |
| | 4729.3 | 11.0 | Sm | 4746.3 | 11.3 | Sm |
| | 4735.3 | 11.1 | Sm | 4748.9 | 11.3 | Bl |
| | 4740.9 | 11.1 | Bl | 4758.3 | 11.9 | Sm |
| *145971* S APODIS— | | | | | | |
| | 4731.3 | 9.9 | En | 4746.3 | 10.4 | Sm |
| | 4734.3 | 10.4 | Sm | 4748.9 | 9.8 | Bl |
| | 4738.3 | 9.8 | En | 4754.3 | 10.2 | En |
| | 4740.9 | 9.8 | Bl | 4758.3 | 10.1 | Sm |
| | 4745.3 | 10.1 | En | 4759.3 | 10.1 | En |
| *150605* Y LIBRAE— | | | | | | |
| | 4765.3 | 10.5 | L | 4774.3 | 11.3 | L |
| *151520* S LIBRAE— | | | | | | |
| | 4767.3 | 9.5 | L | | | |

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926—Continued.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| 151714 S SERPENTIS— | | | | | | |
| | 4765.3 | 7.6 | L | 4785.5 | 8.0 | Ie |
| | 4774.3 | 7.7 | L | 4791.6 | 8.4 | Pt |
| | 4781.3 | 7.9 | L | | | |
| 151731 S CORONAE BOREALIS— | | | | | | |
| | 4781.7 | 10.8 | Sg | 4796.5 | 9.3 | B |
| | 4791.6 | 10.0 | Pt | | | |
| *151822* RS LIBRAE— | | | | | | |
| | 4729.3 | 8.3 | Sm | 4749.3 | 8.9 | Ht |
| | 4733.3 | 8.6 | Ht | 4754.3 | 8.6 | Sm |
| | 4734.3 | 9.0 | En | 4754.3 | 9.2 | Ht |
| | 4735.3 | 8.3 | Sm | 4755.3 | 8.9 | En |
| | 4741.3 | 8.9 | Ht | 4759.3 | 9.4 | Sm |
| | 4741.3 | 8.9 | En | 4767.3 | 9.9 | L |
| | 4748.9 | 7.8 | Bl | | | |
| *152714* RU LIBRAE— | | | | | | |
| | 4767.3 | 9.9 | L | 4778.3 | 8.5 | L |
| *152849* R NORMAE— | | | | | | |
| | 4729.3 | 7.2 | Sm | 4748.9 | 7.6 | Bl |
| | 4734.3 | 7.5 | En | 4754.3 | 7.5 | Sm |
| | 4735.3 | 7.3 | Sm | 4755.3 | 8.3 | En |
| | 4741.2 | 7.5 | En | 4759.3 | 7.5 | Sm |
| | 4746.3 | 7.5 | Sm | | | |
| *153215* W LIBRAE— | | | | | | |
| | 4754.9 | [13.1 | Bl | | | |
| 153378 S URSAE MINORIS— | | | | | | |
| | 4791.6 | 9.8 | Pt | 4802.5 | 10.4 | Mh |
| | 4795.6 | 10.0 | Ya | | | |
| *153654* T NORMAE— | | | | | | |
| | 4729.3 | 7.5 | Sm | 4746.3 | 8.9 | Sm |
| | 4733.2 | 8.3 | Bl | 4749.2 | 9.3 | Bl |
| | 4735.3 | 7.8 | Sm | 4754.2 | 9.9 | Bl |
| | 4741.2 | 8.7 | Bl | 4758.3 | 9.7 | Sm |
| 154428 R CORONAE BOREALIS— | | | | | | |
| | 4613.0 | 6.6 | H | 4780.5 | 5.5 | Bx |
| | 4751.0 | 6.2 | H | 4780.6 | 6.2 | Pc |
| | 4784.0 | 6.4 | H | 4780.6 | 6.1 | Pt |
| | 4731.1 | 5.5 | H | 4781.7 | 6.2 | Sg |
| | 4754.1 | 5.8 | Ch | 4782.3 | 6.2 | Kl |
| | 4755.1 | 5.8 | Ch | 4784.4 | 6.1 | L |
| | 4760.3 | 6.0 | Be | 4787.6 | 6.0 | Pc |
| | 4764.1 | 5.8 | Ch | 4788.4 | 6.5 | Kl |
| | 4765.3 | 6.1 | Be | 4791.5 | 6.0 | O |
| | 4765.1 | 5.8 | Ch | 4791.5 | 6.1 | Pt |
| | 4765.4 | 6.0 | L | 4792.5 | 6.1 | Pt |
| | 4767.4 | 6.0 | L | 4792.6 | 6.0 | Pc |
| | 4767.4 | 6.3 | Kl | 4793.3 | 6.3 | Kl |
| | 4768.1 | 5.8 | Ch | 4793.5 | 6.5 | Bx |
| | 4768.3 | 6.0 | Be | 4794.5 | 6.2 | Bx |
| | 4768.3 | 6.1 | L | 4794.5 | 6.1 | Pt |
| | 4770.2 | 6.1 | Ch | 4795.5 | 6.2 | Ya |
| | 4771.3 | 6.5 | Kl | 4796.6 | 6.1 | Pt |
| | 4772.4 | 6.1 | L | 4796.6 | 6.0 | Pc |
| | 4773.3 | 6.4 | Kl | 4797.5 | 6.1 | Pt |
| | 4773.4 | 6.0 | Be | 4798.5 | 6.0 | Bx |
| | 4774.3 | 6.0 | L | 4800.5 | 6.0 | Ms |
| | 4775.3 | 6.1 | L | 4800.5 | 6.4 | Mh |
| | 4776.3 | 6.0 | L | 4800.5 | 6.1 | Pt |
| | 4777.3 | 6.0 | L | 4800.7 | 5.5 | Sg |
| | 4777.6 | 6.1 | Pc | 4801.5 | 6.0 | Ms |
| | 4778.6 | 6.1 | Pc | 4802.5 | 6.1 | Pt |
| 154428 R CORONAE BOR.—Continued. | | | | | | |
| | 4779.3 | 6.0 | L | 4804.5 | 6.2 | Pt |
| | 4779.6 | 6.1 | Pt | | | |
| 154536 X CORONAE BOREALIS— | | | | | | |
| | 4796.5 | 13.3 | B | | | |
| 154615 R SERPENTIS— | | | | | | |
| | 4798.5 | 13.0 | B | | | |
| 154639 V CORONAE BOREALIS— | | | | | | |
| | 4791.6 | 6.4 | Pt | 4798.5 | 7.0 | B |
| | 4795.6 | 7.2 | Ya | | | |
| 155229 Z CORONAE BOREALIS— | | | | | | |
| | 4791.6 | [12.5 | O | 4795.5 | [13.2 | B |
| *155823* RZ SCORPII— | | | | | | |
| | 4729.2 | 9.3 | Sm | 4746.3 | 9.3 | Sm |
| | 4733.3 | 9.3 | Ht | 4749.3 | 9.5 | Ht |
| | 4734.3 | 9.3 | En | 4754.3 | 9.7 | Ht |
| | 4735.3 | 9.4 | Sm | 4755.3 | 9.5 | En |
| | 4738.3 | 9.3 | En | 4758.3 | 10.0 | Sm |
| | 4741.3 | 9.2 | Ht | | | |
| *160021* S SCORPII— | | | | | | |
| | 4729.2 | 10.6 | Sm | 4754.3 | 10.3 | Ht |
| | 4733.3 | 10.9 | Ht | 4754.3 | 10.3 | Sm |
| | 4734.3 | 10.3 | En | 4755.3 | 10.3 | En |
| | 4735.3 | 10.5 | Sm | 4759.3 | 10.1 | Sm |
| | 4741.3 | 10.4 | En | 4767.3 | 10.1 | L |
| | 4741.3 | 10.7 | Ht | 4778.3 | 10.0 | L |
| | 4748.9 | 10.5 | Bl | | | |
| 160118 R HERCULIS— | | | | | | |
| | 4755.1 | 9.3 | Ch | 4791.6 | 9.5 | Pt |
| | 4768.1 | 8.6 | Ch | 4795.6 | 9.6 | B |
| | 4777.6 | 9.0 | Pc | | | |
| 160210 U SERPENTIS— | | | | | | |
| | 4782.5 | 10.6 | B | 4791.6 | 11.8 | Pt |
| | 4785.5 | 11.0 | Ie | 4798.5 | 12.4 | B |
| *160221a* X SCORPII— | | | | | | |
| | 4748.9 | 11.7 | Bl | | | |
| 160325 SX HERCULIS— | | | | | | |
| | 4765.4 | 7.7 | L | 4794.5 | 8.3 | Pt |
| | 4775.3 | 7.9 | L | 4796.6 | 8.2 | Pt |
| | 4779.6 | 7.8 | Pt | 4797.5 | 8.3 | Pt |
| | 4780.6 | 7.9 | Pt | 4800.5 | 8.5 | Pt |
| | 4791.5 | 8.2 | Pt | 4802.5 | 8.6 | Pt |
| | 4792.5 | 8.2 | Pt | 4804.5 | 8.5 | Pt |
| 160625 RU HERCULIS— | | | | | | |
| | 4772.4 | 14.3 | L | | | |
| *161122a* R SCORPII— | | | | | | |
| | 4754.3 | 12.1 | Ht | 4755.3 | 12.4 | En |
| | 4754.3 | 12.0 | Sm | 4759.3 | 11.9 | Sm |
| | 4755.0 | 11.9 | Bl | 4792.5 | 11.3 | Pt |
| *161122b* S SCORPII— | | | | | | |
| | 4729.2 | 11.0 | Sm | 4748.9 | 11.1 | Bl |
| | 4733.3 | 11.0 | Bl | 4754.3 | 11.5 | Sm |
| | 4734.3 | 10.7 | En | 4755.0 | 11.4 | Bl |
| | 4735.3 | 10.2 | Sm | 4755.3 | 12.2 | En |
| | 4741.3 | 11.3 | En | 4759.3 | 11.5 | Sm |
| | 4741.3 | 10.9 | Bl | | | |
| 161138 W CORONAE BOREALIS— | | | | | | |
| | 4791.6 | 12.1 | O | 4795.6 | 11.5 | B |

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926—Continued.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| *161607* W OPHIUCHI— | | | | | | |
| | 4767.3 | 9.8 | L | 4782.9 | 9.9 | B |
| | 4768.1 | 10.5 | Ch | 4792.5 | 10.5 | Pt |
| | 4776.3 | 9.9 | L | | | |
| *162112* V OPHIUCHI— | | | | | | |
| | 4768.1 | 8.0 | Ch | 4792.5 | 7.2 | Pt |
| 162119 U HERCULIS— | | | | | | |
| | 4767.3 | 8.8 | Kl | 4782.3 | 9.3 | Kl |
| | 4768.1 | 8.6 | Ch | 4788.3 | 9.4 | Kl |
| | 4771.3 | 9.1 | Kl | 4791.6 | 9.5 | O |
| | 4773.3 | 8.9 | Kl | 4792.5 | 9.3 | Pt |
| | 4777.6 | 9.1 | Pc | 4793.3 | 9.5 | Kl |
| | 4779.6 | 9.2 | O | 4796.5 | 9.2 | B |
| 162807 SS HERCULIS— | | | | | | |
| | 4791.6 | 12.3 | Pt | 4795.5 | 11.7 | B |
| *162816* S OPHIUCHI— | | | | | | |
| | 4748.9 | 9.4 | Bl | 4778.3 | 10.2 | L |
| | 4768.3 | 10.2 | L | | | |
| 163137 W HERCULIS— | | | | | | |
| | 4791.6 | 12.5 | Pt | 4795.6 | 11.4 | B |
| 163172 R URSAE MINORIS— | | | | | | |
| | 4774.4 | 10.1 | Lp | 4796.6 | 9.0 | B |
| | 4793.4 | 9.5 | Lp | | | |
| 163266 R DRACONIS— | | | | | | |
| | 4755.1 | 11.3 | Ch | 4791.5 | 9.3 | Pt |
| | 4774.4 | 10.8 | Lp | 4792.4 | 9.3 | Lp |
| | 4782.6 | 10.3 | B | 4797.6 | 9.3 | Ya |
| | 4783.4 | 10.5 | Lp | | | |
| *164319* RR OPHIUCHI— | | | | | | |
| | 4729.2 | 9.0 | Sm | 4759.3 | 8.6 | Sm |
| | 4734.3 | 8.8 | En | 4768.3 | 8.7 | Be |
| | 4735.2 | 8.8 | Sm | 4768.3 | 8.6 | L |
| | 4741.3 | 8.8 | En | 4778.3 | 9.3 | L |
| | 4754.3 | 8.6 | Sm | 4782.6 | 9.6 | B |
| | 4755.3 | 8.9 | En | 4791.6 | 10.1 | Pt |
| 164715 S HERCULIS— | | | | | | |
| | 4791.6 | 12.5 | Pt | 4795.6 | 12.0 | B |
| *164844* RS SCORPII— | | | | | | |
| | 4731.3 | [12.5 | En | 4755.3 | [11.7 | En |
| | 4754.3 | 12.0 | Sm | 4759.3 | 11.7 | Sm |
| | 4755.0 | 12.0 | Bl | | | |
| *165030* RR SCORPII— | | | | | | |
| | 4748.9 | 7.0 | Bl | | | |
| *165202* SS OPHIUCHI— | | | | | | |
| | 4791.6 | 13.6 | Pt | | | |
| 165631 RV HERCULIS— | | | | | | |
| | 4789.6 | 12.1 | B | 4797.6 | [13.7 | Lv |
| | 4791.6 | 13.0 | Pt | | | |
| *165636* RT SCORPII— | | | | | | |
| | 4755.0 | [14.0 | Bl | | | |
| *170215* R OPHIUCHI— | | | | | | |
| | 4797.5 | 12.2 | B | | | |
| 170627 RT HERCULIS— | | | | | | |
| | 4791.6 | 11.0 | O | 4798.6 | 9.8 | B |
| | 4791.6 | 11.0 | Pt | | | |
| *170833* RW SCORPII— | | | | | | |
| | 4748.9 | 10.8 | Bl | | | |
| 171401 Z OPHIUCHI— | | | | | | |
| | 4791.6 | 10.2 | Pt | 4798.6 | 9.7 | B |
| 171723 RS HERCULIS— | | | | | | |
| | 4791.6 | 11.8 | Pt | 4794.3 | 11.7 | B |
| *172486* S OCTANTIS— | | | | | | |
| | 4729.2 | 9.8 | Sm | 4748.9 | 10.7 | Bl |
| | 4733.2 | 10.3 | Ht | 4754.3 | 12.0 | Ht |
| | 4735.3 | 10.3 | Sm | 4758.3 | 12.1 | Sm |
| | 4741.2 | 10.6 | Ht | | | |
| 172809 RU OPHIUCHI— | | | | | | |
| | 4791.6 | 12.6 | Pt | 4798.6 | 12.3 | B |
| *173212* RT SERPENTIS— | | | | | | |
| | 4772.3 | 10.8 | L | | | |
| *173543* RU SCORPII— | | | | | | |
| | 4748.9 | 9.6 | Bl | | | |
| *174135* SV SCORPII— | | | | | | |
| | 4748.9 | 9.6 | Bl | | | |
| *174162* W PAVONIS— | | | | | | |
| | 4731.3 | [12.1 | En | 4755.0 | [13.0 | Bl |
| | 4738.3 | [12.1 | En | 4759.2 | [12.1 | En |
| 174406 RS OPHIUCHI— | | | | | | |
| | 4791.6 | 11.0 | Pt | | | |
| *174551* U ARAE— | | | | | | |
| | 4729.2 | 8.6 | Sm | 4754.3 | 7.8 | Sm |
| | 4734.2 | 8.4 | En | 4755.3 | 7.8 | En |
| | 4735.2 | 8.5 | Sm | 4759.3 | 7.8 | Sm |
| | 4741.2 | 8.2 | En | | | |
| 175111 RT OPHIUCHI— | | | | | | |
| | 4791.6 | 11.0 | Pt | 4798.6 | 11.2 | B |
| | 4793.6 | 11.0 | O | | | |
| 175458a T DRACONIS— | | | | | | |
| | 4786.6 | 12.8 | B | | | |
| 175458b UY DRACONIS— | | | | | | |
| | 4786.6 | 10.7 | B | | | |
| 175519 RY HERCULIS— | | | | | | |
| | 4791.6 | 11.5 | Pt | 4794.6 | 11.3 | B |
| 175654 V DRACONIS— | | | | | | |
| | 4791.6 | 13.0 | Pt | | | |
| *180363* R PAVONIS— | | | | | | |
| | 4731.3 | 9.5 | En | 4746.3 | 8.5 | Sm |
| | 4733.2 | 9.5 | Ht | 4749.3 | 8.9 | Ht |
| | 4734.2 | 9.1 | Sm | 4754.2 | 8.3 | Ht |
| | 4738.3 | 8.9 | En | 4755.3 | 8.1 | En |
| | 4741.2 | 9.1 | Ht | 4758.3 | 8.1 | Sm |
| | 4745.3 | 8.7 | En | | | |
| 180531 T HERCULIS— | | | | | | |
| | 4754.2 | 11.1 | Ch | 4792.4 | 11.1 | Lp |
| | 4768.3 | 11.7 | L | 4793.6 | 11.1 | Bx |
| | 4778.3 | 11.8 | L | 4800.5 | 10.1 | Ie |
| | 4783.4 | 11.8 | Lp | 4800.5 | 10.7 | Mh |
| | 4791.6 | 11.3 | O | 4806.6 | 9.0 | Hu |
| | 4791.6 | 11.1 | Pt | | | |
| 180565 W DRACONIS— | | | | | | |
| | 4786.6 | 10.4 | B | 4798.6 | 10.1 | B |
| | 4791.6 | 10.2 | Pt | | | |
| 180666 X DRACONIS— | | | | | | |
| | 4786.6 | 11.1 | B | | | |
| 181103 RY OPHIUCHI— | | | | | | |
| | 4793.6 | 12.1 | O | 4794.6 | 12.5 | Pt |
| 181136 W LYRAE— | | | | | | |
| | 4644.0 | 8.2 | Nk | 4794.6 | 8.0 | Pt |
| | 4767.4 | 8.7 | L | 4794.6 | 8.1 | B |
| | 4778.3 | 8.5 | L | 4804.6 | 8.7 | Jo |
| | 4790.6 | 9.0 | Jo | 4806.6 | 8.3 | Hu |

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926—Continued.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| *182133* RV SAGITTARII— | | | | | | |
| | 4755.0 | 12.1 | Bl | | | |
| 182224 SV HERCULIS— | | | | | | |
| | 4798.6 | 13.3 | B | | | |
| 182306 T SERPENTIS— | | | | | | |
| | 4796.6 | 11.5 | Pt | 4803.5 | 11.0 | B |
| 183225 RZ HERCULIS— | | | | | | |
| | 4791.6 | 10.0 | O | | | |
| 183308 X OPHIUCHI— | | | | | | |
| | 4765.4 | 7.7 | L | 4792.6 | 7.4 | Jo |
| | 4765.4 | 7.6 | Be | 4793.6 | 7.3 | O |
| | 4775.3 | 7.1 | L | 4796.6 | 6.8 | Pt |
| | 4790.6 | 7.3 | Jo | 4798.6 | 7.3 | B |
| 184134 RV LYRAE— | | | | | | |
| | 4796.6 | 9.6 | Pt | | | |
| *184205* R SCUTI— | | | | | | |
| | 4683.0 | 5.6 | H | 4785.6 | 5.4 | Ie |
| | 4731.1 | 7.1 | H | 4785.6 | 5.4 | Lg |
| | 4739.1 | 6.7 | H | 4786.6 | 5.4 | O |
| | 4741.1 | 6.7 | H | 4787.6 | 5.3 | Lg |
| | 4757.0 | 6.9 | H | 4787.6 | 5.2 | Pc |
| | 4755.1 | 6.8 | Ch | 4788.6 | 5.3 | Lg |
| | 4760.3 | 6.3 | Be | 4789.6 | 5.2 | Lg |
| | 4762.3 | 6.2 | L | 4790.6 | 5.2 | Lg |
| | 4765.3 | 5.9 | L | 4791.5 | 5.1 | Pt |
| | 4765.3 | 6.0 | Be | 4791.6 | 5.2 | Pc |
| | 4765.6 | 5.9 | Lg | 4792.5 | 5 1 | Pt |
| | 4766.6 | 5.8 | Lg | 4792.6 | 5.3 | Pc |
| | 4767.4 | 5.8 | Be | 4793.6 | 5.1 | Lg |
| | 4768.7 | 5.7 | Lg | 4794.5 | 5.3 | Pt |
| | 4769.2 | 5.8 | Ch | 4796.6 | 5.2 | Pt |
| | 4769.7 | 5.7 | Lg | 4796.6 | 5.3 | Pc |
| | 4770.7 | 5.8 | Lg | 4797.6 | 5.7 | O |
| | 4772.4 | 5.7 | L | 4797.6 | 5.4 | Pt |
| | 4774.3 | 5.6 | L | 4797.7 | 5.0 | Lg |
| | 4774.3 | 5.7 | Be | 4800.5 | 5.8 | Ms |
| | 4777.6 | 5.3 | Pc | 4800.5 | 5 7 | Ie |
| | 4778.6 | 5.3 | Pc | 4800.5 | 5.2 | Mh |
| | 4779.6 | 5.1 | Pt | 4800.5 | 5.5 | Pt |
| | 4780.6 | 5.1 | Pt | 4801.5 | 5.7 | Ms |
| | 4780.6 | 5.3 | Pc | 4802.5 | 5.5 | Pt |
| | 4781.3 | 5.1 | L | 4804.5 | 5.6 | Ms |
| | 4781.6 | 5.6 | Lg | 4804.5 | 5.5 | Pt |
| | 4782.6 | 5.3 | Pc | | | |
| 184243 RW LYRAE— | | | | | | |
| | 4794.6 | [13.8 | B | | | |
| 184300 NOVA AQUILAE— | | | | | | |
| | 4670.1 | 10.4 | Nk | 4779.6 | 11.0 | Pt |
| | 4704.0 | 10.4 | Nk | 4785.6 | 10.7 | Ie |
| | 4706.3 | 10.5 | Nk | 4791.5 | 10 8 | Pt |
| | 4714.0 | 10.4 | Nk | 4794.5 | 10.9 | Pt |
| | 4725.0 | 10.4 | Nk | 4800.5 | 10.7 | Pt |
| | 4727.0 | 10.4 | Nk | 4804.5 | 11.0 | Pt |
| | 4769.2 | 10.4 | Ch | | | |
| *185437a* S CORONAE AUSTRALIS— | | | | | | |
| | 4748.9 | 11.5 | Bl | 4755.0 | 11.9 | Bl |
| *185512a* ST SAGITTARII— | | | | | | |
| | 4768.3 | [13.5 | L | | | |
| *185537a* R CORONAE AUSTRALIS— | | | | | | |
| | 4755.0 | 13.0 | Bl | | | |
| *185537b* T CORONAE AUSTRALIS— | | | | | | |
| | 4755.0 | 13.0 | Bl | | | |
| 185634 Z LYRAE— | | | | | | |
| | 4796.6 | 11.6 | B | 4798.6 | 11.8 | B |
| | 4796.6 | 10.7 | Pt | | | |
| 185737 RT LYRAE— | | | | | | |
| | 4770.2 | 11.9 | Ch | | | |
| *185905* V AQUILAE— | | | | | | |
| | 4800.5 | 8.1 | Mh | | | |
| 190108 R AQUILAE— | | | | | | |
| | 4769.2 | 6.8 | Ch | 4793.4 | 5.5 | Lp |
| | 4772.4 | 6.1 | Lp | 4793.6 | 5.5 | O |
| | 4783.4 | 5.8 | Lp | 4796.6 | 6.0 | Pt |
| | 4785.6 | 5.8 | Pw | 4798.6 | 6.4 | B |
| *190818* RX SAGITTARII— | | | | | | |
| | 4765.1 | 9.8 | Ch | 4796.6 | 9.6 | B |
| | 4796.6 | 9.6 | Pt | | | |
| *190819a* RW SAGITTARII— | | | | | | |
| | 4765.1 | 9.7 | Ch | 4796.6 | 9.7 | B |
| | 4796.6 | 9.8 | Pt | | | |
| 190907 TY AQUILAE— | | | | | | |
| | 4796.6 | 10.1 | Pt | | | |
| 190925 S LYRAE— | | | | | | |
| | 4790.6 | [13.7 | Lv | 4796.6 | [13.7 | Lv |
| | 4791.6 | 14.1 | B | | | |
| 190926 X LYRAE— | | | | | | |
| | 4796.6 | 9.0 | Pt | | | |
| 190933a RS LYRAE— | | | | | | |
| | 4790.6 | 13.7 | Lv | 4796.6 | 13.2 | Lv |
| 190941 RU LYRAE— | | | | | | |
| | 4796.6 | 12.1 | Pt | | | |
| 190967 U DRACONIS— | | | | | | |
| | 4796.6 | 13.0 | Pt | | | |
| *191007* W AQUILAE— | | | | | | |
| | 4796.6 | 12.1 | Pt | | | |
| *191017* T SAGITTARII— | | | | | | |
| | 4765.1 | 9.1 | Ch | 4796.6 | 8.9 | Pt |
| *191019* R SAGITTARII— | | | | | | |
| | 4765.1 | 10.0 | Ch | 4798.6 | 8.2 | Ya |
| | 4796.6 | 7.9 | Pt | | | |
| *191033* RY SAGITTARII— | | | | | | |
| | 4729.3 | 6.9 | Sm | 4774.3 | 6.6 | L |
| | 4731.3 | 7.1 | En | 4777.6 | 6.7 | Pc |
| | 4733.3 | 6.5 | Ht | 4779.3 | 6.4 | L |
| | 4734.2 | 6.8 | Sm | 4779.6 | 6.6 | Pt |
| | 4738.3 | 6.7 | Ht | 4780.6 | 6.6 | Pt |
| | 4741.2 | 6.9 | En | 4781.3 | 6.1 | L |
| | 4741.3 | 6.7 | Ht | 4791.5 | 6.4 | Pt |
| | 4746.2 | 6.8 | Sm | 4792.5 | 6.3 | Pt |
| | 4748.9 | 6.2 | Bl | 4794.5 | 6.3 | Pt |
| | 4749.3 | 6.9 | Ht | 4796.6 | 6.4 | Pt |
| | 4754.1 | 6.5 | Ch | 4797.5 | 6.4 | Pt |
| | 4754.2 | 6.7 | Ht | 4800.5 | 6.5 | Pt |
| | 4757.3 | 7.0 | En | 4802.5 | 6.5 | Pt |
| | 4758.2 | 7.0 | Sm | 4804.5 | 6.5 | Pt |
| | 4765.1 | 6.5 | Ch | | | |
| *191124* TY SAGITTARII— | | | | | | |
| | 4755.0 | 9.8 | Bl | | | |
| *191319a* S SAGITTARII— | | | | | | |
| | 4755.0 | 11.4 | Bl | 4798.6 | [11.1 | Ya |
| | 4796.6 | 10.8 | Pt | | | |

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926—Continued.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| *191331* SW SAGITTARII— | | | | | | |
| | 4749.0 | 9.8 | Bl | | | |
| 191350 TZ CYGNI— | | | | | | |
| | 4796.6 | 10.6 | Pt | | | |
| 191637 U LYRAE— | | | | | | |
| | 4796.6 | 9.0 | Pt | | | |
| 192928 TY CYGNI— | | | | | | |
| | 4770.2 | 9.8 | Ch | 4796.6 | 11.0 | Pt |
| 193311 RT AQUILAE— | | | | | | |
| | 4798.6 | 13.8 | B | | | |
| 193449 R CYGNI— | | | | | | |
| | 4519.9 | 8.8 | Nk | 4796.6 | 11.0 | Hu |
| | 4521.9 | 8.9 | Nk | 4796.6 | 12.0 | Pt |
| | 4531.0 | 9.1 | Nk | 4797.6 | 11.7 | B |
| | 4790.6 | 12.2 | Lv | 4799.2 | 10.1 | Gs |
| | 4796.6 | 12.1 | Lv | | | |
| 193732 TT CYGNI— | | | | | | |
| | 4796.6 | 7.5 | Hu | | | |
| *193972* T PAVONIS— | | | | | | |
| | 4733.2 | 10.4 | Ht | 4749.0 | 8.7 | Bl |
| | 4734.2 | 11.0 | Sm | 4749.2 | 8.9 | Ht |
| | 4741.2 | 9.8 | Ht | 4754.2 | 8.5 | Ht |
| | 4746.3 | 9.2 | Sm | 4758.3 | 8.6 | Sm |
| 194048 RT CYGNI— | | | | | | |
| | 4769.1 | 9.5 | Ch | 4796.6 | 7.7 | Pt |
| | 4785.6 | 8.5 | Pw | 4796.7 | 8.4 | Pc |
| | 4790.7 | 8.3 | Jo | 4797.7 | 8.1 | B |
| | 4792.7 | 8.0 | Jo | 4802.8 | 7.5 | Sg |
| | 4796.6 | 8.3 | Lv | 4804.6 | 7.8 | Jo |
| | 4796.6 | 8.5 | Hu | | | |
| 194348 TU CYGNI— | | | | | | |
| | 4769.1 | 9.5 | Ch | 4796.6 | 9.6 | Pt |
| | 4790.6 | 9.7 | Lv | 4796.6 | 9.6 | Hu |
| | 4796.6 | 9.9 | Lv | 4797.6 | 9.7 | B |
| 194604 X AQUILAE— | | | | | | |
| | 4793.7 | 12.7 | Lv | 4796.6 | 12.7 | Pt |
| | 4796.6 | 12.6 | Lv | 4798.6 | 12.8 | B |
| 194632 χ CYGNI— | | | | | | |
| | 4519.9 | 5.7 | Nk | 4796.6 | 13.5 | Pt |
| | 4777.6 | 12.8 | L | 4796.6 | 13.1 | B |
| *194929* RR SAGITTARII— | | | | | | |
| | 4749.0 | 5.5 | Bl | | | |
| *195142* RU SAGITTARII— | | | | | | |
| | 4729.3 | 12.1 | Sm | 4741.2 | 12.1 | Ht |
| | 4731.3 | [12.1 | En | 4755.0 | 13.5 | Bl |
| | 4733 3 | 11.9 | Ht | 4758.2 | 13.2 | Sm |
| | 4735.2 | 12.1 | Sm | 4759.3 | [12.0 | En |
| | 4741.2 | [12.2 | En | | | |
| *195202* RR AQUILAE— | | | | | | |
| | 4790.6 | 11.0 | B | 4796.6 | 11.0 | Pt |
| *195308* RS AQUILAE— | | | | | | |
| | 4790.6 | [13.8 | B | | | |
| 195849 Z CYGNI— | | | | | | |
| | 4521.9 | 8.1 | Nk | 4714.0 | 11.4 | Nk |
| | 4531.0 | 8.3 | Nk | 4727.0 | 10.4 | Nk |
| | 4670.2 | 12.5 | Nk | 4771.2 | 9.0 | Ch |
| | 4705.0 | 12.2 | Nk | 4796.6 | 9.0 | Pt |
| | 4708.1 | 12.2 | Nk | 4803.6 | 9.1 | Ie |
| *195855* S TELESCOPII— | | | | | | |
| | 4755.0 | 13.0 | Bl | | | |
| 200212 SY AQUILAE— | | | | | | |
| | 4790.6 | 13.5 | B | 4796.6 | 13.0 | Pt |
| 200357 S CYGNI— | | | | | | |
| | 4772.1 | 11.7 | Ch | 4793.4 | [13.0 | Lp |
| | 4785.6 | 12.0 | Ie | 4796.6 | 12.7 | Pt |
| | 4790.7 | 12.7 | Lv | 4796.6 | 13.3 | Lv |
| *200514* R CAPRICORNI— | | | | | | |
| | 4796.6 | 12.1 | Pt | 4798.7 | 12.0 | B |
| | 4796.6 | 12.2 | Lv | | | |
| 200647 SV CYGNI— | | | | | | |
| | 4796.6 | 8 0 | Hu | | | |
| 200715a S AQUILAE— | | | | | | |
| | 4772.2 | 9.6 | Ch | 4793.6 | 9.2 | O |
| | 4790.6 | 9.2 | B | 4796.6 | 8.8 | Pt |
| | 4793.4 | 9.1 | Lp | 4798.6 | 9.0 | Ya |
| 200715b RW AQUILAE— | | | | | | |
| | 4790.6 | 9.3 | B | 4796.6 | 9.2 | Pt |
| | 4793.6 | 9.5 | O | 4798.6 | 9.1 | Ya |
| *200747* R TELESCOPII— | | | | | | |
| | 4749.0 | 12.3 | Bl | | | |
| 200812 RU AQUILAE— | | | | | | |
| | 4790.6 | 13.7 | B | 4796.7 | 13.5 | Lv |
| | 4790.7 | 13.6 | Lv | | | |
| *200822* W CAPRICORNI— | | | | | | |
| | 4755.0 | 12.5 | Bl | | | |
| *200906* Z AQUILAE— | | | | | | |
| | 4790.6 | 12.9 | B | 4796.6 | 12.7 | Pt |
| 200916 R SAGITTAE— | | | | | | |
| | 4790.6 | 9.3 | B | 4798.6 | 9.2 | Ya |
| 200938 RS CYGNI— | | | | | | |
| | 4755.1 | 7.2 | Ch | 4790.7 | 7.5 | Jo |
| | 4769.0 | 7.2 | Ch | 4796.6 | 7.2 | Pt |
| | 4770.2 | 7.2 | Ch | 4802.8 | 7.0 | Sg |
| | 4772.4 | 7.0 | L | 4804.6 | 7.4 | Jo |
| | 4781.3 | 7.4 | L | | | |
| 201008 R DELPHINI— | | | | | | |
| | 4772.3 | 12.1 | L | 4796.6 | 12.6 | Pt |
| | 4784 3 | 12.2 | L | 4800.6 | 13.1 | Ie |
| | 4790.7 | 12.7 | B | | | |
| *201121* RT CAPRICORNI— | | | | | | |
| | 4796.6 | 6.6 | Pt | | | |
| 201130 SX CYGNI— | | | | | | |
| | 4785.6 | 9.4 | Ie | 4796.6 | 9.4 | Pt |
| | 4795.7 | 9.5 | B | 4800.7 | 9.4 | B |
| *201139* RT SAGITTARII— | | | | | | |
| | 4749.0 | 10.6 | Bl | | | |
| 201437b WX CYGNI— | | | | | | |
| | 4755.1 | 11.6 | Ch | 4796.7 | 10.5 | Lv |
| | 4769.0 | 11.5 | Ch | 4800.7 | 10.3 | B |
| | 4790.7 | 10.7 | Lv | 4802.8 | 10.0 | Sg |
| | 4792.7 | 10.0 | Jo | 4803.6 | 10.7 | Ie |
| | 4796.6 | 10.9 | Pt | 4804.6 | 10.2 | Jo |
| 201647 U CYGNI— | | | | | | |
| | 4519.9 | 8.7 | Nk | 4700.0 | 10.1 | Nk |
| | 4521.9 | 8.7 | Nk | 4704.0 | 10.2 | Nk |
| | 4531.0 | 9.0 | Nk | 4705.1 | 10.3 | Nk |
| | 4582.3 | 9.0 | Nk | 4711.0 | 10.5 | Nk |
| | 4644.0 | 9.1 | Nk | 4725.0 | 10.6 | Nk |
| | 4651.3 | 9.5 | Nk | 4769.1 | 10.8 | Ch |
| | 4668.0 | 10 2 | Nk | 4796.6 | 9.9 | Lv |
| | 4669.0 | 10.1 | Nk | 4796.6 | 9.0 | Pt |

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926—Continued.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| 201647 U CYGNI—Continued. | | | | | | |
| | 4670.1 | 10.1 | Nk | 4796.6 | 9.5 | B |
| | 4672.0 | 9.9 | Nk | 4802.8 | 8.5 | Sg |
| | 4685.1 | 10.0 | Nk | 4804.6 | 9.2 | Ms |
| | 4699.1 | 10.0 | Nk | 4804.6 | 9.9 | Jo |
| *202240* U MICROSCOPII— | | | | | | |
| | 4755.0 | 12.7 | Bl | | | |
| 202817 Z DELPHINI— | | | | | | |
| | 4790.7 | [13.7 | Lv | 4796.6 | [13.7 | B |
| | 4796.7 | [13.4 | Lv | | | |
| 202946 SZ CYGNI— | | | | | | |
| | 4779.6 | 9.4 | Pt | 4796.6 | 9.0 | Pt |
| | 4780.6 | 9.2 | Pt | 4797.5 | 9.0 | Pt |
| | 4784.8 | 9.0 | Pt | 4798.7 | 9.0 | Pt |
| | 4789.7 | 9.5 | Pt | 4800.5 | 8.9 | Pt |
| | 4791.5 | 9.5 | Pt | 4802.5 | 9.4 | Pt |
| | 4792.5 | 9.6 | Pt | 4803.8 | 9.0 | Pt |
| | 4794.5 | 9.6 | Pt | 4804.5 | 9.4 | Pt |
| | 4795.8 | 9.0 | Pt | 4805.8 | 9.7 | Pt |
| 202954 ST CYGNI— | | | | | | |
| | 4796.6 | 10.4 | Pt | 4801.7 | 11.0 | Lv |
| | 4800.7 | 11.0 | B | | | |
| 203226 V VULPECULAE— | | | | | | |
| | 4796.6 | 8.7 | Pt | | | |
| *203420* R MICROSCOPII— | | | | | | |
| | 4749.0 | 8.7 | Bl | | | |
| 203611 Y DELPHINI— | | | | | | |
| | 4791.7 | 13.6 | B | | | |
| 203816 S DELPHINI— | | | | | | |
| | 4670.2 | 11.9 | Nk | 4714.0 | 10.9 | Nk |
| | 4674.3 | 12.2 | Nk | 4725.0 | 10.6 | Nk |
| | *4701.0* | *11.8* | *Nk* | *4727.0* | 10.3 | Nk |
| | 4706.3 | 11.6 | Nk | 4791.7 | 10.0 | B |
| | 4708.1 | 11.2 | Nk | 4796.6 | 9.6 | Pt |
| | 4711.0 | 11.0 | Nk | 4797.6 | 10.4 | O |
| 203847 V CYGNI— | | | | | | |
| | 4796.6 | 12.6 | Pt | 4801.7 | 13.0 | Lv |
| | 4800.7 | 13.0 | B | | | |
| *203905* Y AQUARII— | | | | | | |
| | 4772.2 | 11.1 | Ch | 4796.6 | 10.5 | Pt |
| | 4785.6 | 10.7 | Ie | 4798.6 | 10.6 | Ya |
| | 4795.6 | 10.7 | B | 4800.5 | 11.1 | Mh |
| 204016 T DELPHINI— | | | | | | |
| | 4714.0 | 9.5 | Nk | 4791.7 | 12.1 | B |
| | 4725.0 | 9.4 | Nk | 4796.6 | 12.8 | Pt |
| | 4727.0 | 9.2 | Nk | 4797.6 | 12.5 | O |
| | 4772.2 | 11.4 | Ch | 4800.6 | 13.0 | Ie |
| | 4789.6 | 12.9 | Cl | | | |
| 204102 V AQUARII— | | | | | | |
| | 4796.6 | 8.3 | Pt | 4798.6 | 8.7 | B |
| | 4798.6 | 8.7 | Ya | | | |
| *204104* W AQUARII— | | | | | | |
| | 4772.3 | 12.6 | L | 4796.6 | 12.5 | B |
| | 4784.3 | 12.6 | L | 4802.6 | 13.3 | B |
| *204215* U CAPRICORNI— | | | | | | |
| | 4755.0 | 12.0 | Bl | 4798.7 | 14.0 | B |
| 204318 V DELPHINI— | | | | | | |
| | 4791.7 | 13.0 | B | | | |
| *204405* T AQUARII— | | | | | | |
| | 4772.2 | 8.0 | Ch | 4796.6 | 7.6 | Pt |
| | 4790.6 | 7.5 | Jo | 4798.6 | 7.6 | Ya |
| *204405* T AQUARII—Continued. | | | | | | |
| | 4792.6 | 7.4 | Jo | 4800.5 | 8.0 | Mh |
| | 4795.6 | 7.7 | B | | | |
| 204846 RZ CYGNI— | | | | | | |
| | 4796.6 | 12.1 | Pt | 4807.8 | 12.5 | Lv |
| | 4800.7 | 12.0 | B | | | |
| 205017 X DELPHINI— | | | | | | |
| | 4790.7 | [13.7 | Lv | 4796.7 | [13.3 | Lv |
| | 4796.6 | 13.8 | B | | | |
| 205923a R VULPECULAE— | | | | | | |
| | 4790.7 | 9.7 | Lv | 4797.6 | 9.4 | B |
| | 4796.6 | 9.5 | Pt | 4800.6 | 9.0 | Hu |
| | 4796.7 | 9.6 | Lv | | | |
| *210124* V CAPRICORNI— | | | | | | |
| | 4755.0 | 13.0 | Bl | | | |
| 210129 TW CYGNI— | | | | | | |
| | 4800.5 | 10.0 | Ie | 4800.7 | 10.0 | B |
| 210382 X CEPHEI— | | | | | | |
| | 4797.6 | [13.5 | B | | | |
| *210504* RS AQUARII— | | | | | | |
| | 4772.3 | 10.8 | L | 4795.7 | 10.2 | B |
| | 4784.3 | 10.2 | L | 4796.7 | 10.2 | Pt |
| *210516* Z CAPRICORNI— | | | | | | |
| | 4796.7 | 10.9 | Pt | 4802.6 | 11.0 | B |
| 210812 R EQUULEI— | | | | | | |
| | 4790.5 | 12.3 | B | 4796.7 | 13.5 | Pt |
| | 4793.6 | [13.0 | Cl | | | |
| 210868 T CEPHEI— | | | | | | |
| | 4519.9 | 9.8 | Nk | 4752.2 | 6.2 | Ch |
| | 4523.0 | 10.0 | Nk | 4764.2 | 6.4 | Ch |
| | 4531.0 | *10.1* | *Nk* | *4765.4* | *6.1* | L |
| | 4670.2 | 7.5 | Nk | 4772.2 | 6.5 | Ch |
| | 4708.1 | 7.0 | Nk | 4776.3 | *6.1* | L |
| | 4714.0 | 7.1 | Nk | 4796.7 | 7.1 | Pt |
| | 4717.0 | 7.1 | Nk | 4797.6 | 7.0 | B |
| | *4725.0* | *6.5* | *Nk* | | | |
| *210903* RR AQUARII— | | | | | | |
| | 4795.7 | 9.9 | B | 4796.7 | 9.6 | Pt |
| 211614 X PEGASI— | | | | | | |
| | 4790.5 | 10.0 | B | 4797.7 | 10.8 | Pw |
| | 4796.7 | 10.5 | Pt | | | |
| *211615* T CAPRICORNI— | | | | | | |
| | 4749.0 | 11.4 | Bl | 4798.6 | [11.1 | Ya |
| | 4791.6 | 13.1 | B | | | |
| *212814* Y CAPRICORNI— | | | | | | |
| | 4802.6 | [13.3 | B | | | |
| 213244 W CYGNI— | | | | | | |
| | 4765.3 | 6.2 | L | | | |
| 213678 S CEPHEI— | | | | | | |
| | 4794.5 | 8.7 | Lp | 4797.6 | 8.6 | B |
| | 4796.7 | 7.5 | Pt | 4800.6 | 7.9 | Hu |
| 213753 RU CYGNI— | | | | | | |
| | 4519.9 | 9.4 | Nk | 4531.0 | 9.2 | Nk |
| 213843 SS CYGNI— | | | | | | |
| | 4519.9 | 11.8 | Nk | 4774.3 | 10.8 | L |
| | 4521.9 | 11.4 | Nk | 4775.3 | 11.0 | L |
| | 4522.9 | 10.5 | Nk | 4776.3 | 11.1 | L |
| | 4527.0 | 9.0 | Nk | 4777.6 | 11.6 | L |
| | 4528.9 | 8.3 | Nk | 4777.6 | [11.0 | Pc |
| | 4531.0 | 8.3 | Nk | 4779.3 | 11.6 | L |
| | 4537.0 | 8.3 | Nk | 4779.6 | 11.8 | Pt |

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1926—Continued.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| 213843 SS CYGNI—Continued. | | | | | | |
| | 4538.0 | 8.4 | Nk | 4780.6 | 11.8 | Pt |
| | 4566.9 | 11.5 | Nk | 4784.4 | 11.8 | L |
| | 4578.3 | 11.8 | Nk | 4784.8 | 11.7 | Pt |
| | 4647.3 | 8.4 | Nk | 4785.5 | 11.9 | Ie |
| | 4669.2 | 11.6 | Nk | 4785.6 | 11.7 | Pw |
| | 4670.1 | 11.6 | Nk | 4789.6 | 11.9 | Cl |
| | 4674.3 | 11.2 | Nk | 4789.7 | 11.7 | Pt |
| | 4685.1 | 11.8 | Nk | 4790.7 | 12.0 | Lv |
| | 4699.0 | 11.8 | Nk | 4791.5 | 11.8 | Pt |
| | 4701.0 | 11.9 | Nk | 4791.6 | 11.9 | Pw |
| | 4705.0 | 11.8 | Nk | 4792.5 | 11.8 | Pt |
| | 4708.1 | 10.3 | Nk | 4793.3 | 11.3 | Kl |
| | 4710.0 | 8.3 | Nk | 4793.5 | 11.9 | Bx |
| | 4711.0 | 8.3 | Nk | 4793.6 | 11.9 | Cl |
| | 4712.3 | 8.4 | Nk | 4794.5 | 12.1 | Cl |
| | 4714.0 | 10.9 | Nk | 4794.5 | 11.8 | Pt |
| | 4725.0 | 11.7 | Nk | 4795.5 | 11.6 | Ya |
| | 4727.0 | 11.9 | Nk | 4795.7 | [11.5 | Pc |
| | 4752.2 | [9.6 | Ch | 4795.8 | 11.6 | Pt |
| | 4754.1 | 11.8 | Ch | 4796.7 | 11.7 | Pt |
| | 4755.1 | 11.8 | Ch | 4796.7 | 11.6 | Pc |
| | 4756.2 | 11.7 | Ch | 4696.7 | 11.8 | B |
| | 4760.4 | 9.2 | L | 4797.5 | 11.8 | Pt |
| | 4762.3 | 9.0 | L | 4797.7 | 11.7 | B |
| | 4762.4 | 8.7 | L | 4797.7 | 11.8 | Pw |
| | *4763.6* | 8.9 | L | 4798.6 | 11.9 | B |
| | [illegible] | | | | | |
| | 4764.2 | 8.7 | Ch | 4798.6 | 11.8 | Cl |
| | 4764.4 | 8.6 | Kl | 4798.7 | 11.6 | Pt |
| | *4765.1* | 8.5 | Ch | *4800.6* | *[10.9* | Ms |
| | 4765.4 | 8.8 | L | 4800.5 | 11.8 | Pt |
| | 4766.3 | 8.7 | L | 4800.5 | 11.9 | Ie |
| | 4766.3 | 8.8 | Kl | 4800.6 | 12.0 | Hu |
| | *4767.3* | *9.3* | Kl | *4800.7* | *11.9* | *B* |
| | 4767.4 | 9.1 | L | 4801.7 | 11.9 | Lv |
| | 4768.4 | 9.5 | L | 4802.5 | 11.6 | Pt |
| | 4769.0 | 8.8 | Ch | 4802.8 | 12.0 | Sg |
| | 4770.2 | 9.7 | Ch | 4803.5 | 11.8 | Ie |
| | 4770.6 | 10.2 | L | 4803.7 | 11.9 | B |
| | 4771.2 | 9.9 | Ch | 4803.8 | 11.8 | Pt |
| | 4771.3 | 10.0 | Kl | 4804.6 | [10.9 | Ms |
| | 4772.3 | 10.1 | Ch | 4804.5 | 11.8 | Pt |
| | 4772.4 | 10.3 | L | 4805.8 | 11.8 | Pt |
| | 4773.3 | 10.5 | L | 4806.6 | 12.0 | Hu |
| | 4773.3 | 10.3 | Kl | | | |
| 213937 RV CYGNI— | | | | | | |
| | 4796.7 | 6.7 | Pt | 4800.6 | 7.2 | Hu |
| 214024 RR PEGASI— | | | | | | |
| | 4791.5 | 13.1 | B | 4796.7 | 13.2 | Pt |
| *214247* R GRUIS— | | | | | | |
| | 4729.3 | 8.6 | Sm | 4746.2 | 8.9 | Sm |
| | 4733.3 | 8.6 | Ht | 4749.0 | 9.7 | Bl |
| | 4734.3 | 8.6 | En | 4754.2 | 9.7 | Ht |
| | 4735.3 | 8.6 | Sm | 4755.3 | 9.9 | En |
| | 4741.2 | 8.9 | En | 4758.3 | 9.5 | Sm |
| | 4741.3 | 8.6 | Ht | | | |
| 215605 V PEGASI— | | | | | | |
| | 4790.6 | 12.8 | B | 4796.7 | 12.3 | Pt |
| *215717* U AQUARII— | | | | | | |
| | 4795.6 | 11.5 | B | 4798.6 | 12.0 | Ya |
| | 4796.7 | 11.8 | Pt | | | |
| 215934 RT PEGASI— | | | | | | |
| | 4791.5 | [13.0 | B | 4796.7 | 11.3 | Pt |
| 220133a RY PEGASI— | | | | | | |
| | 4791.6 | 12.6 | B | 4796.7 | 10.5 | Pt |
| 220133b RZ PEGASI— | | | | | | |
| | 4791.6 | 10.5 | B | | | |
| 220412 T PEGASI— | | | | | | |
| | 4793.5 | [13.5 | B | | | |
| 220613 Y PEGASI— | | | | | | |
| | 4786.6 | 12.5 | O | 4796.7 | 11.5 | Pt |
| | 4793.6 | 11.4 | B | | | |
| 220714 RS PEGASI— | | | | | | |
| | 4793.6 | 12.2 | B | 4796.7 | 12.1 | Pt |
| *221938* T GRUIS— | | | | | | |
| | 4729.3 | 8.8 | Sm | 4746.2 | 9.0 | Sm |
| | 4735.3 | 8.8 | Sm | 4758.3 | 9.2 | Sm |
| *221948* S GRUIS— | | | | | | |
| | 4734.3 | [12.2 | En | 4759.2 | [12.2 | En |
| 222129 RV PEGASI— | | | | | | |
| | 4797.5 | 10.4 | B | | | |
| 222439 S LACERTAE— | | | | | | |
| | 4796.7 | 12.0 | Pt | 4801.7 | 12.0 | Lv |
| *222867* R INDI— | | | | | | |
| [illegible] | | | | | | |
| | 4749.0 | 11.0 | Bl | | | |
| *223462* T TUCANAE— | | | | | | |
| | 4733.3 | 10.9 | Ht | 4746.3 | 12.3 | Sm |
| | 4734.2 | 11.1 | Sm | 4754.2 | 11.8 | Ht |
| | 4741.3 | 11.1 | Ht | 4757.2 | 12.0 | En |
| | *4741.3* | *11.2* | En | *4758.3* | *12.6* | *Sm* |
| 223841 R LACERTAE— | | | | | | |
| | 4796.7 | 10.8 | Pt | | | |
| *225120* S AQUARII— | | | | | | |
| | 4795.7 | 11.4 | B | | | |
| 225914 RW PEGASI— | | | | | | |
| | 4789.6 | [13.0 | Cl | 4797.5 | 12.4 | B |
| | 4796.7 | 12.4 | Pt | | | |
| 230110 R PEGASI— | | | | | | |
| | 4767.3 | 10.4 | Kl | 4786.6 | 11.5 | O |
| | 4771.3 | 10.4 | Kl | 4796.7 | 11.9 | Pt |
| 230759 V CASSIOPEIAE— | | | | | | |
| | 4529.9 | 10.7 | Nk | 4795.6 | 11.8 | B |
| | 4531.0 | 10.7 | Nk | 4796.2 | 11.4 | Ch |
| | 4549.0 | 11.7 | Nk | 4796.7 | 11.5 | Pt |
| | 4791.6 | 12.0 | O | | | |
| 231425 W PEGASI— | | | | | | |
| | 4767.3 | 9.0 | Kl | 4782.3 | 8.3 | Kl |
| | 4770.1 | 8.9 | Ch | 4785.3 | 8.4 | Kl |
| | 4771.3 | 8.7 | Kl | 4788.3 | 8.2 | Kl |
| | 4773.3 | 8.8 | Kl | 4793.3 | 8.4 | Kl |
| | 4778.4 | 8.4 | Kl | | | |
| 231508 S PEGASI— | | | | | | |
| | 4770.1 | 9.6 | Ch | 4796.6 | 8.6 | Pt |
| | 4786.6 | 9.2 | O | | | |
| *232746* V PHOENICIS— | | | | | | |
| | 4757.3 | [12.0 | En | | | |

232848 Z Andromedae—
4770.1 9.5 Ch 4796.7 9.8 Pt
4786.6 9.8 O

233335 ST Andromedae—
4770.1 8.7 Ch 4790.6 8.8 Lg
4787.6 8.8 Lg 4793.6 8.9 Lg
4786.6 8.9 O 4796.6 8.5 Hu
4788.6 8.8 Lg 4696.7 8.8 Pt
4789.6 8.8 Lg 4797.7 9.0 Lg

*233815* R Aquarii—
4764.2 10.2 Ch 4796.7 10.0 Pt
4795.7 11.0 B

233956 Z Cassiopeiae—
4794.7 [13.5 B

235053 RR Cassiopeiae—
4763.4 [13.1 Bn 4791.3 13.0 Bn
4769.4 [13.1 Bn 4794.7 13.2 B
4785.3 13.2 Bn 4799.3 12.7 Bn

*235209* V Ceti—
4763.6 10.6 L 4770.6 11.7 L

*235265* R Tucanae—
4735.3 [12.9 Sm 4754.3 [12.9 Sm
4741.3 [12.0 En 4757.3 [12.0 En

235350 R Cassiopeiae—
4521.0 12.0 Nk 4795.6 8.9 B
4779.6 9.0 O

235525 Z Pegasi—
4519.9 9.4 Nk 4786.6 8.8 O
4531.0 9.5 Nk 4796.7 8.6 Pt
4548.9 11.0 Nk

235855 Y Cassiopeiae—
4794.7 10.5 B

235939 SV Andromedae—
4785.5 12.7 Ie 4796.7 12.5 Pt
4796.6 12.6 Hu

Total observations, 1586; stars observed, 336; total observers, 29.

The following members were elected to the Council: Miss Alice H. Farnsworth, of Mt. Holyoke College; Charles W. Elmer, of New York; M. J. Jordan, of Boston; George Van Biesbroeck, of Yerkes Observatory.

The following were chosen as officers for the coming year: President, Charles C. Godfrey; Vice President, Alice H. Farnsworth; Secretary, Wm. Tyler Olcott, and Treasurer, M. J. Jordan.

Thirty-five new members were reported elected during the year, including two life members and Dr. Ejnar Hertzsprung as Honorary Member.

The Association gathered at the Hotel Bellevue in Boston for its annual dinner, which was presided over by Dean Potter of Leonia, N. J., as Toastmaster. Dr. Shapley, as joint host, welcomed the Association and the Neighborhood Club, and predicted a still closer co-operation between amateur and professional as the result of the meeting just brought to a close. Professor Schlesinger, Director of the Yale Observatory, took the occasion to present in person to Dr. Shapley the Draper Gold Medal of the National Academy for his researches in Astrophysics. Professor Brown, as well as Professor Schlesinger, stressed the importance of extending the activities of the Association in other lines, suggesting, as possible fields, meteors and occultations. The Council will immediately take the necessary steps to put these suggestions into effect.

The following observers have contributed to this report of observations received during the month of October, 1926: Baldwin, "Bl"; Benini, "Be"; Barnes, "Bx"; Brown, "Bn"; Bouton, "B"; Chandra, "Ch"; Clement, "Cl"; Ensor, "En"; Goodsell, "Gs"; Hama, "H"; Houghton, "Ht"; Hunter, "Hu"; Iedema, "Ie"; Jones, "Jo"; Kohl, "Kl"; Lacchini, "L"; Leavenworth, "Lv"; Lepper, "Lp"; Logan, "Lg"; Marshall, "Mh"; Mrs. Morris, "Ms"; Nakamura, "Nk"; Olcott, "O"; Peltier, "Pt"; Proctor, "Pc"; Skaggs, "Sg"; Smith, "Sm"; Watson, "Pw"; and Yalden, "Ya".

Leon Campbell, Recording Secretary.

November 12, 1926.

## GENERAL NOTES.

### Notes from the Yerkes Observatory.

PROFESSOR FRANK E. ROSS spent part of August and September and the first half of October at the Lick and Mt. Wilson Observatories, where, by the courtesy of the directors, he was given an opportunity to use the 36-inch refractor and the 60-inch reflector for the photography of Mars. He took with him an improved enlarging camera which was made according to his design in the shop of the Yerkes Observatory, intended for the photography of the planets and moon, with light of different wave-lengths. He was favored with the best seeing on October 16, and secured excellent photographs of Mars with the 60-inch Mt. Wilson reflector. Some of these are to be published in the *Astrophysical Journal* for November.

DR. OTTO STRUVE visited the Observatories of the Pacific Coast during the summer, spending twelve weeks at the Mt. Wilson Observatory, where he was given the opportunity of continuing his studies of the calcium clouds as indicated in the stellar spectra.

DR. GEORGE WILBUR MOFFITT, for some years member of the scientific staff of the Research Laboratory of the Eastman Kodak Company, at Rochester, and more recently Optical Engineer at the Frankfort Arsenal of the U. S. Army, was appointed Research Associate from September 1. He will work chiefly in the Department of Astrometry.

WILLIAM W. MORGAN of Washington and Lee University, Virginia, was appointed as assistant in Astrophysics, from September 1.

MISS BERTHA HIRT succeeded Mrs. O. J. Lee as office secretary on August 1.

The following graduate students are working at the Observatory during the autumn quarter:

N. T. BOBROVNIKOFF, fellow in astronomy.

RICHARD A. ROBB, M.A. and B.S., of the University of Glasgow, holder of a fellowship out of the Commonwealth Fund.

CHARLES HUJER, of Prague, who has a traveling fellowship from the Czecho-Slovakian Republic.

ALEXANDER POGO, who has the degree of Electrical Engineer and Mechanical Engineer from the University of Liege, and M.A. in Mathematics from Columbia University.

The structural iron and interior sheathing of the great dome has been painted two coats during this autumn. This was the first time this has been done since 1897, and was something of a major operation. The steel work under the rising floor was also painted at this time. This work made it necessary to give up observations during the day time for six weeks, but the telescope was free for work each night when the weather permitted. The clear weather, however, has been very infrequent during the present autumn.

November 17, 1926.

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**Professor R. A. Millikan** has been elected a foreign member of the Göttingen Academy of Sciences. (*The American Mathematical Monthly*, October, 1926.)

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**Professor M. I. Pupin,** of Columbia University, has received an honorary degree from Rutgers University. (*The American Mathematical Monthly*, October, 1926.)

**Dr. Herbert A. Howe,** dean of the college of liberal arts at the University of Denver, and director of the Chamberlin Observatory at the university, has died at the age of sixty-eight years. (*Science*, November 12, 1926.)

**Professor Hermann Weyl of Zurich,** a delegate from Switzerland to the International Congress of Philosophy at Cambridge, Mass., recently visited several of the universities of the east and middle west. While at the University of Michigan he gave lectures on the "Rôle of Infinity" and "Modern Concepts of Gravitation." (*The American Mathematical Monthly*, October, 1926.)

**The Oldest Observatory on the Earth.** —The progress of the excavations in the region of the ancient Mayan culture in Yucatan has, according to the *Vossische Zeitung*, recently brought to light the oldest observatory on the earth. It is in the neighborhood of the city named Chichen Itza, the ancient city of the Mayas. In a tower-like building there are still remnants of a winding staircase. The platform was covered over and in the westernly direction there was a narrow opening in the wall which made it possible to observe the sun and stars on the western horizon. Correct notes of solar and lunar eclipses, of the equinoxes, of the exact solar year, and of the planets visible to the naked eye give indication of the development of astronomy among the Mayas. (*Sirius*, October, 1926. Translation.)

**Note Regarding Solar Eclipse, June 29, 1927.** — For those who may wish to arrange to observe the total eclipse of the sun from Al, Norway, on June 29, it may be of interest to know that the Travel and Transport, Ltd. state that boats from Newcastle to Bergen run three times a week during the summer, on Tuesdays, Thursdays, and Saturdays, returning from Bergen on the same days. Incidentally, one can go by rail from Bergen direct to Al. The first class fare from Newcastle to Bergen, including meals, is £8 2 s. 6 d. The second class fare by rail from Bergen to Al is about £1 5 s., and accommodation at a good hotel would cost about £1 per day. For further information, regarding passage, etc., the Director of the Travel and Transport, Ltd., at 141 Victoria street, London, S.W.1, would be pleased to answer queries for any Americans who might approach him on the subject.

Miss Mary Proctor (who has obtained the above information) would like to add, the sooner arrangements are made the better, and personally she is willing to answer queries sent to her address, 35 St. George's Square, London, S.W.1.

**McCormick-Chaloner Solar Eclipse Expedition.**—The Rector and visitors of the University of Virginia have just announced a generous gift from Mr. John Armstrong Chaloner of Virginia to finance an expedition to observe the total eclipse of the sun in Norway on June 29, 1927. The expedition will be in charge of Professor S. A. Mitchell, director of the Leander McCormick Observatory, and the party will be known as the McCormick-Chaloner Solar Eclipse Expedition.

As far as is now known, the McCormick-Chaloner expedition will be the only one from the United States. Its work is that of an attack on the structure of the atom, a work which is now one of the most important pieces of scientific investigation being carried on conjointly by the astronomer, the physicist, and the chemist. Mr. Chaloner is known throughout the United States as a great patron of art and science. It is a very fortunate thing for pure science that men of his calibre are

found here and there throughout the country with vision enough to see the important problems of scientific research. America stands as the leading nation of the world in astronomical investigations mainly for the reason that its rich men have given of their means to build big telescopes and finance important projects.

**The Mathematical Association of America.**—The eleventh annual meeting of the Mathematical Association of America will be held by invitation at the University of Pennsylvania, Philadelphia, on Thursday and Friday, December 30-31, 1926, in affiliation with the American Association for the Advancement of Science and the American Mathematical Society. The Society will hold sessions for the reading of papers on Tuesday and Wednesday. On Thursday morning there will be a joint session with Section A of the American Association and the American Mathematical Society; the program will consist of the retiring address of the president of the Society, Professor G. D. Birkhoff, on "A mathematical critique of some physical theories," the retiring address of the vice-president of Section A of the American Association, Professor W. H. Roever, on "The weight field of force of the earth," and an address by Professor F. D. Murnaghan as a representative of the Mathematical Association on "The duty of exposition, with special reference to the Cauchy-Heaviside theorem." The separate sessions of the Mathematical Association will follow on Thursday afternoon and Friday morning with papers by Professors D. R. Curtiss, F. M. Weida, R. C. Archibald, J. E. Rowe, E. R. Hedrick, E. V. Huntington, Dr. W. D. Lambert and J. H. Pitman. A notable feature of these meetings will be the fourth Josiah Willard Gibbs Lecture, to be given under the auspices of the Society and the American Association by Dr. H. B. Williams, Dalton Professor of Physiology, Columbia University, on "Mathematics and the biological sciences."

The mathematical sessions will be held in the Engineering Building of the University.

## BOOK REVIEWS.

**Der Veränderliche Stern $\zeta$ Geminorum,** by Dr. F. Becker, 56 pages, 3 plates. (Ferd. Dummler, Berlin. Price 3 marks). This little book is a doctor's thesis presented at the University of Münster. It contains a discussion of approximately 8000 observations made by various observers, from those made by Julius Schmidt beginning in 1843 to those made by Erich Leiner which ended in 1922. The reduction of this immense amount of observational material could have been made only by one who was willing to do much drudgery for the sake of the end in view. The author reaches the following conclusions: 1. The visual magnitude at maximum is 3.88, at minimum 4.32. No evidence of a change in amplitude. 2. The time the star is below mean magnitude is less than the time above the mean in the ratio of 1 : 1.14. Secondary variations probable. 3. Elements are: Maximum = J. D. 2410638.86 + $10^d.15380$ E + $1^d.05 \sin (0°.070\,E + 112°)$. 4. The photographic amplitude is 2.3 times the visual amplitude. 5. The calculated mean radius of the star is 18.6 times the solar radius. This monograph will be of interest to all variable star observers.

**Rain Making, and Other Weather Vagaries,** by W. J. Humphreys (The Williams and Wilkins Company, Baltimore, Md., Price $2.50). The contents of this book pertain to a subject which is of interest to everyone. There are times when the ability to bring about rainfall and other times when the ability to prevent

rainfall, would be of untold value—at least from a limited point of view. The author recounts in a most interesting way the childish and necessarily futile attempts by primitive peoples to control rain. He also in an authoritative way shows the inapplicability of suggestions that have been made in our day for the same purpose, even though some of them are along correct scientific lines. The inapplicability lies in the impossibility of constructing physical apparatus on a scale sufficient to cope with the enormous disturbance of normal meteorological conditions that would be necessary for success. He concludes this discussion with this sentence, "The problem, then, of artificially effecting agriculturally adequate precipitation is unsolved, and, so far as we now can see, must so remain." The fallacies in the reasoning which ascribes weather conditions to extra-terrestrial influences are pointed out. Throughout the book there is a vein of subtle humor, which furnishes to the reader amusement and pleasure while he is, at the same time, being made more intelligent.

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**The Romance of Comets,** by Mary Proctor (Harper and Brothers).

This is a brief, popular account of those celestial objects which arouse the curiosity and claim the attention of the average person perhaps more than any others objects. The first chapter gives an account of the appearance of comets before they were so well understood, of the fear caused by them, and of the attempts made to relate them to calamities and misfortune. In subsequent chapters the procedure of the business of "comet-hunting" is discussed, and the circumstances attendant upon the appearance and re-appearance of some of the most remarkable comets, such as Donati's and Halley's, are given in some detail. Later the question of the relation of meteors to comets is considered.

The book is very appropriately dedicated to the memory of Professor Edward E. Barnard, from whose writings, as well as from the writings of R. A. Procter, the father of the authoress, frequent and lengthy quotations are made throughout the book.

This volume furnishes a few hours of easy and entertaining reading for any one who has given any thought to these unusual objects.

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**The Pathfinder Star Maps,** by Edward Skinner King (The Cosmos Press, Inc., Cambridge, Mass., $1.25 per copy). The fact that within the past few months several new sets of star maps, or constellation charts, have appeared may well be taken as an indication of the general growing interest in the stars. Among the new star maps are those mentioned in the title of this note. These possess several features which are most commendable. The few pages of instruction in the use of the maps and of information concerning stars and constellations are efficiently and interestingly arranged. The maps themselves are printed on only one side of the page which makes it possible to use faint illumination back of them without dazzling the eyes and thereby interfering with observing the sky. The maps contain only such lines as are necessary to recognize the principal stars of the constellation and their relation to the fundamental circles, equator and ecliptic, and consequently are readily understood. These maps have appeared in the *Christian Science Monitor* from month to month during the past ten years, and those who have seen them there, and used them, will be pleased to have them in this new form, which, of course, will make them serviceable year after year.